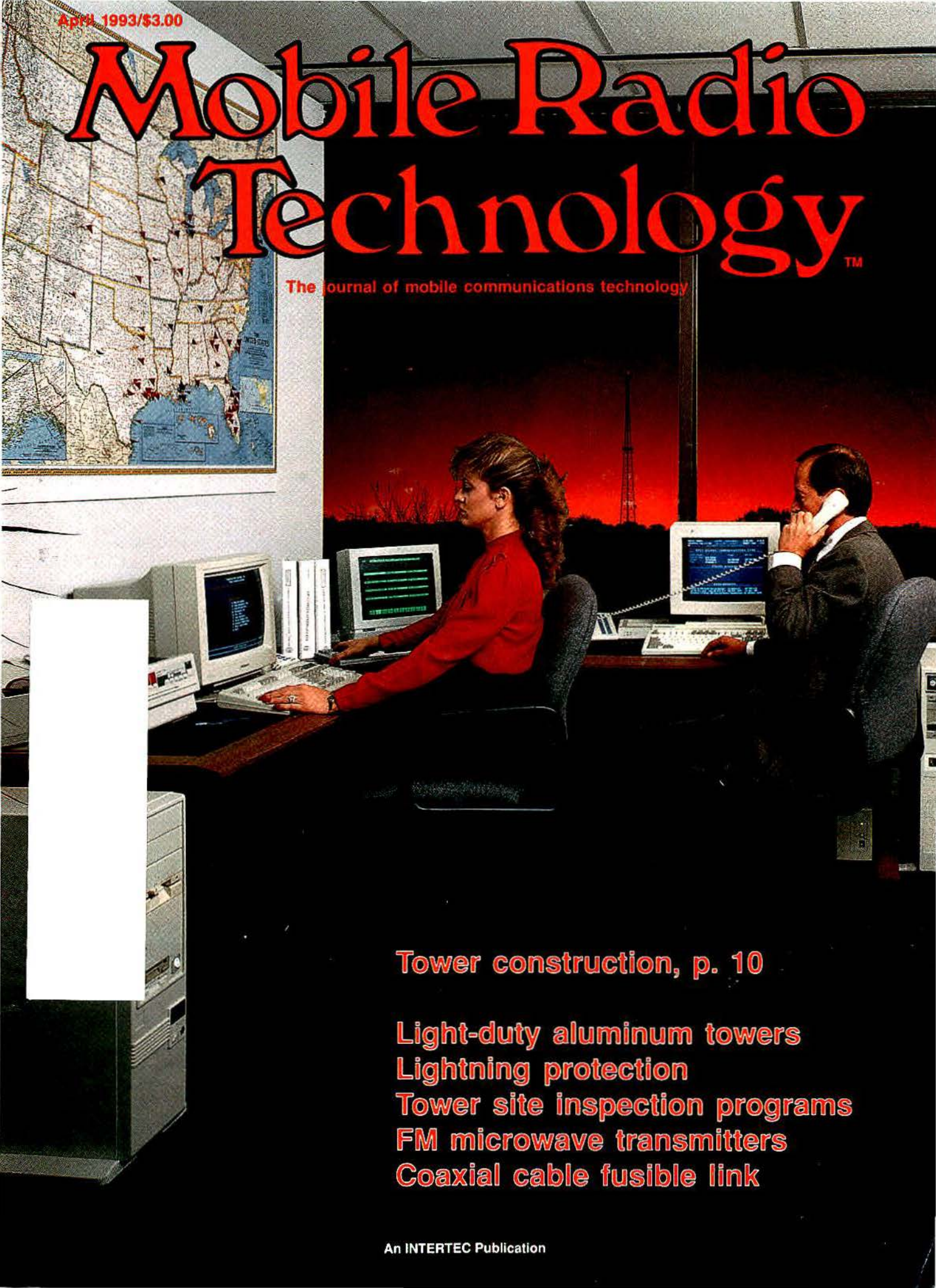


April 1993/\$3.00

Mobile Radio Technology™

The journal of mobile communications technology



Tower construction, p. 10

Light-duty aluminum towers

Lightning protection

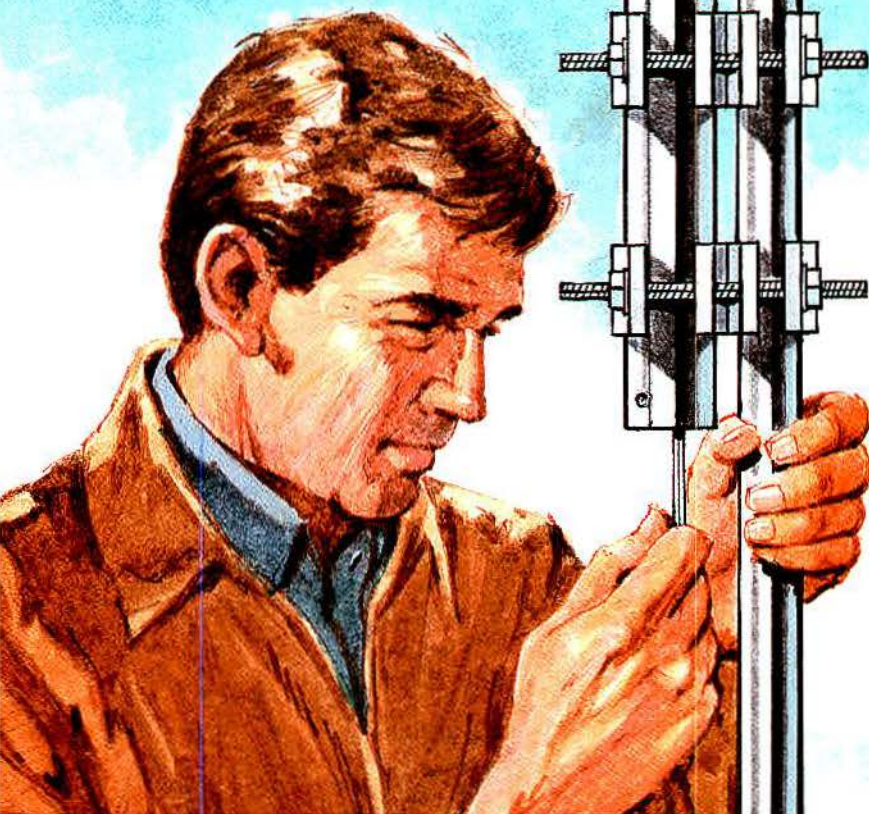
Tower site inspection programs

FM microwave transmitters

Coaxial cable fusible link



Only from Antenna Specialists:



New **"VARI-TILT"**[™] base antennas with Variable Electrical Beamtilt (VEB) you can adjust anywhere in 30 seconds.

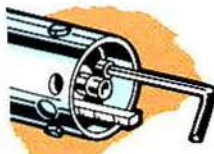
VARI-TILT: The new industry standard ... and then some!

Patents pending

"VARI-TILT" – instantly, whenever you need to fine-tune beamtilt for optimum signal focus below the horizon.

Do it in seconds, before installation or when on the tower, with Antenna Specialists' unique new **"VARI-TILT"** omni-directional base antennas with Variable Electrical Beamtilt (VEB).

Simply insert an ordinary hex wrench at the antenna base, and observe the direct reading calibration rod through the observation port provided.

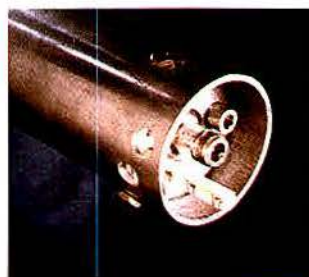
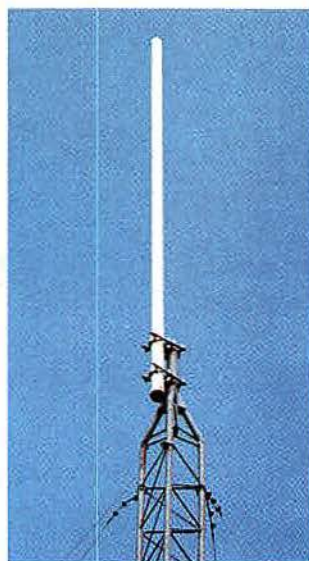


Then, with a twist of the wrist, adjust beamtilt to your exact requirement from -3° to -8° . Simply ingenious!



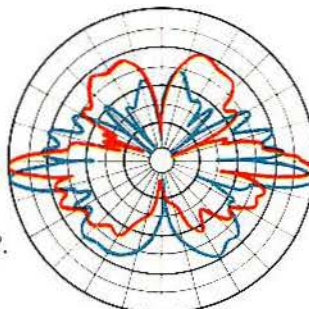
- Adjust beamtilt for optimum null fill precisely in seconds.
- Only a single model required for any negative beamtilt pattern from 3° to 8° below the horizon.
- Does not require removal of radome or changing of jumper cables – maximum convenience, no possible loss of weather-proofing.
- Three models available for cellular, TACS, ETACS, GSM, paging and 800-900 MHz trunking systems.
ASPD977 – 824-896 MHz
ASPA977 – 806-869 MHz
ASPJ977 – 872-960 MHz

- **Electrical Specifications:**
 Power: 500 Watts • Gain: $8\frac{1}{2}$ dB ($\pm \frac{1}{2}$ dB) • VSWR: 1.5:1 • Vertical beamwidth: 7° .
- **Mechanical Specifications:**
 Rated wind velocity (RS-329): 165 mph
 • Length: 14.4 ft. • Weight: 35 lbs.



Typical patterns:

Red line – -3° . Blue line – -8° .



Signature of Quality

the antenna specialists co.

a member of the ALLEN TELECOM GROUP



30500 Bruce Industrial Parkway, Cleveland, OH 44139-3996 • Tel. No. 216/349-8400 • Fax No. 216/349-8407.

© 1993 by the Antenna Specialists Co

Circle (1) on Fast Fact Card

The 10-site radio controller



Vega's C-5111 10-line/4-frequency console

Vega's Model C-5111 compact, easily rack-mounted, ten-line/four-frequency radio control console provides instant PTT, timed mute, and other most-needed features. This tone-format console allows you to quickly select one or any combination of up to 10 remote base stations. A second speaker allows you to monitor (with individual volume controls) any combination of those 10 stations that are not already selected for TX/RX control. Instant PTT switches allow immediate response to a call on a particular "selected" or "unselected" line, without disturbing the programming of the "selected" simulcast group or line.

Standard features available on the cost-effective and versatile C-5111 console include:

- **SELECTED switches** for selecting any combination of lines for transmitting and receiving
- **UNSELECTED switches** for monitoring any combination of unselected lines

- **TX ALL (simulcast) switch** for selecting all lines for both transmit and receive
- **RX ALL switch** for monitoring all unselected lines
- **Separate speakers and volume controls** for "selected" (TX/RX) and "unselected" (RX-only) audio
- **GROUP SELECT switch** for easy selection of TX/RX line combinations
- **TIMED MUTE switch** to mute "unselected" audio temporarily
- **Separate volume controls** for each "unselected" line
- **Instant-PTT switches** for each line
- **Line-activity LEDs** (function on all lines, selected or not)
- **Heavy-duty 120/240-V_{ac} power supply** (also runs on 12 V_{dc})

Options

- **DCA-3 external three-line adapter** for DC-format lines

- **Gooseneck and desk microphones, headsets, footswitch**
- **DTMF pad**
- **Cross mute**
- **Clock, audio-level bargraph, and cross-mute indicators**
- **Rack-mount kit**

The C-5111 has the flexibility to accommodate most any multiline console requirement. Call 1-800-877-1771 (toll-free) now for full details on the C-5111 console.



a **MARK IV** company
Signaling Products Group

9900 East Baldwin Place
El Monte, California 91731-2294
Telephone: (818) 442-0782
Toll-Free Telephone: 800-877-1771
Fax: (818) 444-1342
FaxBack: (818) 444-2017
Toll-Free FaxBack: 800-274-2017

Circle (4) on Fast Fact Card

features

10 How to construct towers for performance, safety, stability

Fred Moore

Choosing the right tower for the mobile radio base station site helps to meet the service priority.

18 Aluminum towers fit light-duty applications

Don Bishop

Temporary radio communications antenna installation requirements may be met with light-duty aluminum towers.

28 Use a unified approach for lightning protection

Bruce A. Kaiser

Effective lightning protection combines bonding and grounding, transient voltage surge suppression and structural lightning protection into a unified system.

38 Inspection programs improve site management results

Bruce A. Kaiser

Use an appropriate inspection program to plan acquisitions, preventive maintenance and upgrades.

50 Adjusting deviation for FM microwave transmitters

Jeff Ashley

Three formulas help technicians to deviate FM microwave transmitters using a variety of test equipment.

62 Coaxial cable fusible link offers lightning protection

Richard Cartoscelli

Small-diameter braided-shield cable may act as a fuse to prevent lightning surge currents from damaging electronic equipment.

departments

4 Editorial

6 Calendar

8 Technically speaking

70 News

77 Regulating technology

80 New products

Swatch and MobileComm, Zetron and Selectone are the "Readers' choice."

90 Literature

91 Feedback

92 People

93 Letters to the editor

96 Classified ads

112 Ad index/hot line

Find advertisers quickly.

113 What do you think?

Mobile Radio Technology (ISSN 0745-7626) is published monthly for free to qualified individuals by Intertec Publishing Corporation, 9800 Metcalf, Overland Park, KS 66212-2215. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address change to MOBILE RADIO TECHNOLOGY, P.O. Box 12960, Overland Park, KS 66282-2960.



page 18



page 38

On the cover: Radio tower monitoring specialists trained to work with alarms, remote interrogation and programming, staff the central monitoring station at LODA, San Antonio, TX.

**AT LAST, MOBILE DATA & STATUS REPORTING
AFFORDABLE FOR SMALLER FLEETS!**



The DATA MESSENGER™ System

Now, the speed, efficiency and accuracy of a **complete** mobile data system is at the fingertips of even the smallest 2-way radio user. Selectone's new **Data Messenger System** can send up to 8 messages of 140 characters each to every system mobile unit (new or existing, trunked or conventional) with an additional 64 messages stored in queue. This complete turnkey system, armed with Selectone proprietary software provides "handshaking" in both directions which virtually guarantees total communications. The system includes an ST-1010 Base Station Controller, the ST-1000 Mobile Data Terminal, mounting bracket and interconnect cables. Installation is fast and easy, thanks to Selectone's Applications Engineering support.

FOR FULL FACTS, CALL:

- Stores up to 8 messages of 140 characters each.
- Eight programmable user-defined status conditions.
- "Handshake" acknowledgement of all transmissions.
- Back-lit mobile display for easy day or night viewing.
- ANI (Automatic Number Identification).
- Complete fleet status display at base station.
- Compact mobile terminal (6.2"L x 3.8"W x 1.6"D).

Circle (5) on Fast Fact Card

Selectone

Selectone Corporation • 23278 Bernhardt Street • Hayward, California 94545
Toll Free: (800) 227-0376 • Fax: (510) 887-4011 • Phone: (510) 887-1950

Scanning . . .



Where we're going

The trend away from component-level troubleshooting and toward systems integration continues.

Technicians are spending less time troubleshooting electronic equipment and more time maintaining systems.

Individual pieces of equipment increasingly are becoming "black boxes" whose inner workings many technicians cannot repair because of the micro-miniature nature of their construction, their reliance on software and their complexity. Often, it is not worth the time required to repair them if a repair can be made.

At the same time, individual pieces of equipment are growing increasingly reliable. Thus, the need to repair them continues to diminish.

Systems in which individual pieces of equipment are installed are becoming more complex. Technicians are moving more into what once was the domain of engineers as they are called upon more often to design radio communications systems, such as the placement and connection of paging transmitters, radio repeaters and the media that link them (telephone wires, radio links and microwave links, usually).

The industry continues to be driven by the supply of its underlying natural resource: radio spectrum. As the supply increases, so do the sales of radio communications equipment. An oversupply does not seem to be imminent.

Presently, the radio communications

spectrum supply is increasing in two ways. The FCC has allocated an additional band of frequencies to private land mobile radio users, and digital radio modulation technology is multiplying the number of users that can share existing spectrum.

Although public networks may be attracting some customers among those that previously have relied upon private networks, it seems that the number of private networks is growing, too.

Personal communications networks, cellular telephone networks and specialized mobile radio (SMR) networks are in the public network category.

The private network category includes radio communications systems owned by those who use them, such as public safety agencies and businesses.

Digital SMR system construction will boost the sales of equipment shelters, coaxial cable, antennas, power supplies, mobile and portable radios, repeaters and control equipment.

Digital SMR systems may draw customers away from community repeaters, as cellular telephone systems have drawn customers away from Improved Mobile Telephone Service (IMTS) systems. It remains to be seen whether many private network operators will switch to SMR and other public networks.

New regulatory environment

In February, the Clinton administration was talking about making government services more responsive.

"The people are our customers," the President's chief of staff said at a news conference. He said that government agencies should pay more attention to the needs of the public and less to their own convenience.

The agency whose actions have the most effect on radio communications service providers and users is the FCC. Despite positive achievements, there is room for improvement in every organization, and the FCC is no exception.

Sometimes, in sidestepping the public interest to one degree or another, the FCC states that a decision is taken because of the economy or conven-

ience it provides the agency. Maybe, with the right encouragement from the administration, the agency's own interests can be eliminated from its decision-making.

RCC vs. PCP

Among the problems that continue to need FCC attention is intentional interference some paging system operators cause to other paging system operators.

The most visible situation of this type usually involves an established radio common carrier (RCC) that vandalizes a private carrier paging (PCP) frequency to defeat PCP competition.

PCP frequencies are shared, so an RCC can obtain a license to activate transmitters on the same frequency as a new PCP competitor. Some RCCs apparently obtain such licenses for the sole purpose of repeating their existing RCC traffic on the PCP channel to tie it up and prevent the PCP operator from serving customers.

There are plenty of reasons why repeating RCC traffic on a PCP channel violates the terms of a PCP license—about 15 reasons, according to a lawsuit filed on behalf of a PCP licensee that is trying to motivate the FCC to offer protection from such interference.

For example, the RCC traffic is common carrier, meaning it has not been screened to ensure that the users fit the eligibility requirements for service on a PCP channel. In fact, RCCs cannot screen their users, under common carrier rules.

Conversely, PCP channels are not authorized for common carrier service, but that is how RCCs that repeat their paging traffic on PCP channels are using them.

RCCs resell telephone service; PCPs cannot. There is a component of reselling in what an RCC charges its customers, and that component remains with the service on the PCP channel, contrary to PCP rules.

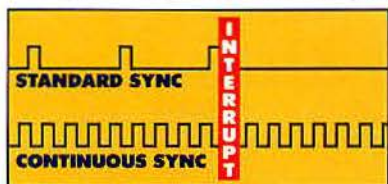
It would be good to see FCC protection extended to PCPs that are suffering from interference because of PCP transmitters operated by RCCs contrary to the terms of their licenses.

—Don Bishop

NOW ALL YOUR CLIENTS CAN GET **MIXED** SIGNALS.

Scrambling For Everyone, Only From Transcript.

Up till now, scrambling for some of your customers has been a mixed blessing. When it worked, it was great. When it didn't, you heard about it. Well, say goodbye to that. Introducing scrambling that works for everyone, every time, only from Transcript International.



With some systems, slow recovery times from loss of signal often means the signal is lost forever. And that has kept many of your customers from scrambling their signal successfully. Now they

can, thanks to continuous sync encryption from Transcript.

With continuous sync encryption, the signal is continually being verified. If an interruption occurs due to marginal signals, hand-offs or step-ons, signal reacquisition is immediate, so your customers can continue to communicate with minimal message loss. This system is the perfect solution for customers with voting or trunked systems, or who broadcast for long periods of time. And it works in existing or new systems.

Continuous sync encryption from Transcript International. The end of scrambling problems for your customers. And you.

FOR INFORMATION, CALL 1-800-228-0226.

TRANSCRIPT
INTERNATIONAL

THE WORLD LEADER IN VOICE PRIVACY AND SIGNALING TECHNOLOGY.

1620 North 20th Street, Lincoln, NE 68503 (402) 435-4400 FAX (402) 435-6780

Circle (6) on Fast Fact Card

April

- 19-22—**Supercomm and Telocator Wireless Conference**, Georgia World Congress Center, Atlanta. Contact: 800-326-8638.
21-23—**North Central Regional Conference Associated Public-Safety Communications Officers Meeting**, Radisson Inn Bismarck, Bismarck, ND. Contact: Lyle V. Gallagher, 701-224-2127.

May

- 12-14—**Mobile Communications Conference**, sponsored by the National Association of Business and Educational Radio (NABER), Hyatt Regency Hotel, San Antonio. Contact: 800-759-0300.
16-19—**East Coast Regional Conference Associated Public-Safety Communications Officers Meeting**, Cavalier Hotel, Virginia Beach, VA. Contact: Bill Marriott, 804-247-8431.
18-20—**Vehicular Technology Conference**, sponsored by IEEE Vehicular Technology Society, Meadowlands Hilton, Secaucus, NJ. Contact: Mel Lewis, Loral Electronics, 914-968-2500, ext. 2304.
26-28—**RadioComm**, Metro Toronto Convention Centre, Toronto. Contact: Lisa La Prairie, 613-233-4888.

June

- 29-July 1—**Utilities Telecommunications Council Annual Meeting**, San Antonio Marriott Rivercenter and Convention Center, San Antonio. Contact: Rita Clark, 301-621-7802.

July

- 18-22—**Forestry-Conservation Communications Association**, Jackson, WY. Contact: Don Pfohl, 602-644-3166.
24-28—**International Municipal Signal Association**, Norfolk, VA. Contact: Harold Glerum, 800-723-4672.

August

- 8-13—**Associated Public-Safety Communications Officers 59th National Conference**, New Orleans Convention Center, New Orleans. Contact: 800-824-1850.

September

- 21-23—**International Mobile Communications Expo/Fall**, Philadelphia Convention Center, Philadelphia. Contact: 303-220-0600.
28-Oct. 1—**Mobile Communications Marketplace**, New Orleans Convention Center, New Orleans. Contact: Telocator, 800-326-8638.

October

- 6-9—**Industrial Telecommunications Association Annual Meeting**, La Quinta Hotel, La Quinta, CA. Contact: Barbara J. Levermann, 703-528-5115.
12-13—**SMR/Private Carrier Management Conference**, Loews Coronado Hotel, San Diego, CA. Contact: 202-331-7773.
16-21—**International Association of Chiefs of Police Annual Conference**, Cervantes Convention Center, St. Louis, MO. Contact: 703-836-6767.

November

- 11-14—**Communications Marketing Conference**, Holiday Inn Riverwalk, San Antonio. Contact: Gene Johnson, Vega Signaling, 818-442-0782.
19—**Radio Club of America Awards Banquet**, New York Athletic Club, New York. Contact: 201-652-6811.

1994

February

- 7-8—**AMTEX**, the American Mobile Telecommunications Association's Marketing and Technology Conference and Exposition, Marriott on International Drive, Orlando. Contact: 202-331-7773.

March

- 2-4—**Cellular Telecommunications Industry Association Winter Meeting and Exposition**, San Diego. Contact: 202-785-0081.
6-9—**Energy Telecommunications and Electrical Association**, Henry B. Gonzales Convention Center, San Antonio. Contact: 214-235-0655.



Mobile Radio Technology

The journal of mobile communications technology

EDITORIAL

Don Bishop, *Editorial Director*
Nancy Campbell, *Senior Associate Editor*
Ellen Payne, *Associate Editor*
Dawn Stillinger, *Graphic Designer*
Harold Kinley, CET, *Contributing Editor*

INDUSTRY CONSULTANT

Fred M. Link

REGULATORY CONSULTANT

Alan S. Tilles, Esq., *Partner*; Meyer, Faller, Weisman & Rosenberg P.C., Washington, DC

EDITORIAL ADVISORY BOARD

Gene A. Buzzi, *President*, Omnicom Telecommunications Engineering, Tallahassee, FL
R. James Evans, *Communications Consultant*, East Lansing, MI
Gary David Gray, P.E., *Chief Telecommunications Engineer*, Orange County Communications, Orange, CA
Frederick G. Griffin, P.E., *President*, Frederick G. Griffin P.C., Lynchburg, VA
Larry Kline, *Beachwood*, OH

S.R. McConoughey, P.E., *Mobile Communications Consulting*, Gaithersburg, MD
Art McDole, *Salinas*, CA
Stuart F. Meyer, *Land Mobile Consultant*, Vienna, VA
Herb Sachs, *Herb Sachs Consulting*, Bowie, MD
Leon Spencer, *Radio Engineering Systems*, Exxon Company USA, Houston, TX
Dr. Gregory M. Stone, *Senior Associate*; Booz, Allen & Hamilton, McLean, VA
Raymond C. Trott, P.E., *President*, Raymond C. Trott Consulting Engineers, Irving, TX
William A. Wickline, P.E., *Mentor*, OH

CORRESPONDENCE: Editorial and advertising correspondence should be addressed to P.O. Box 12901, Overland Park, KS 66282-2901, 913-341-1300, fax: 913-967-1904.

MOBILE RADIO TECHNOLOGY provides technical information to dealers, community repeater operators, specialized mobile radio operators, conventional and cellular RCC and WCC, mobile radio equipment manufacturers, manufacturers' reps, distributors, engineering/consulting firms, national/state/local government, military agencies, public safety agencies, transportation companies, petroleum/energy products companies, public utilities and others allied to the field.

SUBSCRIPTIONS: MOBILE RADIO TECHNOLOGY is circulated without charge in the United States by name and title to personnel who are re-

sponsible for sales, operation or maintenance of mobile radio equipment. Non-qualified subscriptions in the United States are \$30 per year; in Canada, \$36 per year; and in other countries, \$40 per year. Foreign airmail optional at an additional \$65 per year. Single copies are \$3 plus postage and handling; back issues, \$5 postpaid. Adjustment necessitated by subscription termination at single copy rate. Allow six to eight weeks for change of address or for new subscription. Send subscription information to: P.O. Box 12968, Overland Park, KS 66282-2968.

PHOTOCOPY RIGHTS: Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by Intertec Publishing, provided that the base fee of US \$2.00 per copy, plus US \$00.00 per page is paid directly to Copyright Clearance Center, 27 Congress Street, SALEM, MA 01970, USA. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transaction Reporting Service is 0745-7626/1993 \$2.00 + \$00.00.

VBPA ABP \$3.00 + 0.00

Audited circulation:
INTERTEC PUBLISHING

© 1993 by Intertec Publishing.
All rights reserved.

DON'T MOVE... ***TO DIGITAL SECURITY***

Meet the "Top Gun Scrambler"
For the Radius™ P200
and Motorola® HT600*

Cypher-MX™ VSB

The Cypher-MX Variable Split Band Scrambler is close to digital in security, but without the drawbacks of processing delay, lost speaker recognition and reduced range. The MX P1283 is an SMT/PCB module housed in a replacement front cover for either a Radius P200 or Motorola HT600. And in a showdown, Cypher-MX VSB is quicker to install.

For Straight Shooting Information
Call Toll Free:
1-800-638-5577

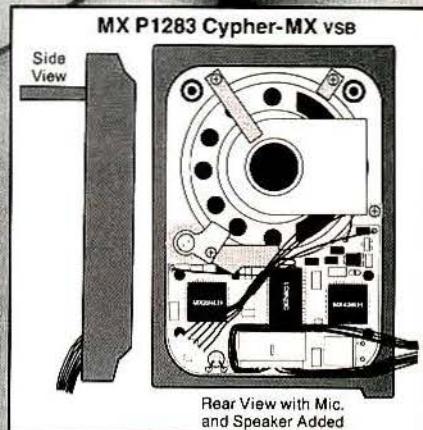
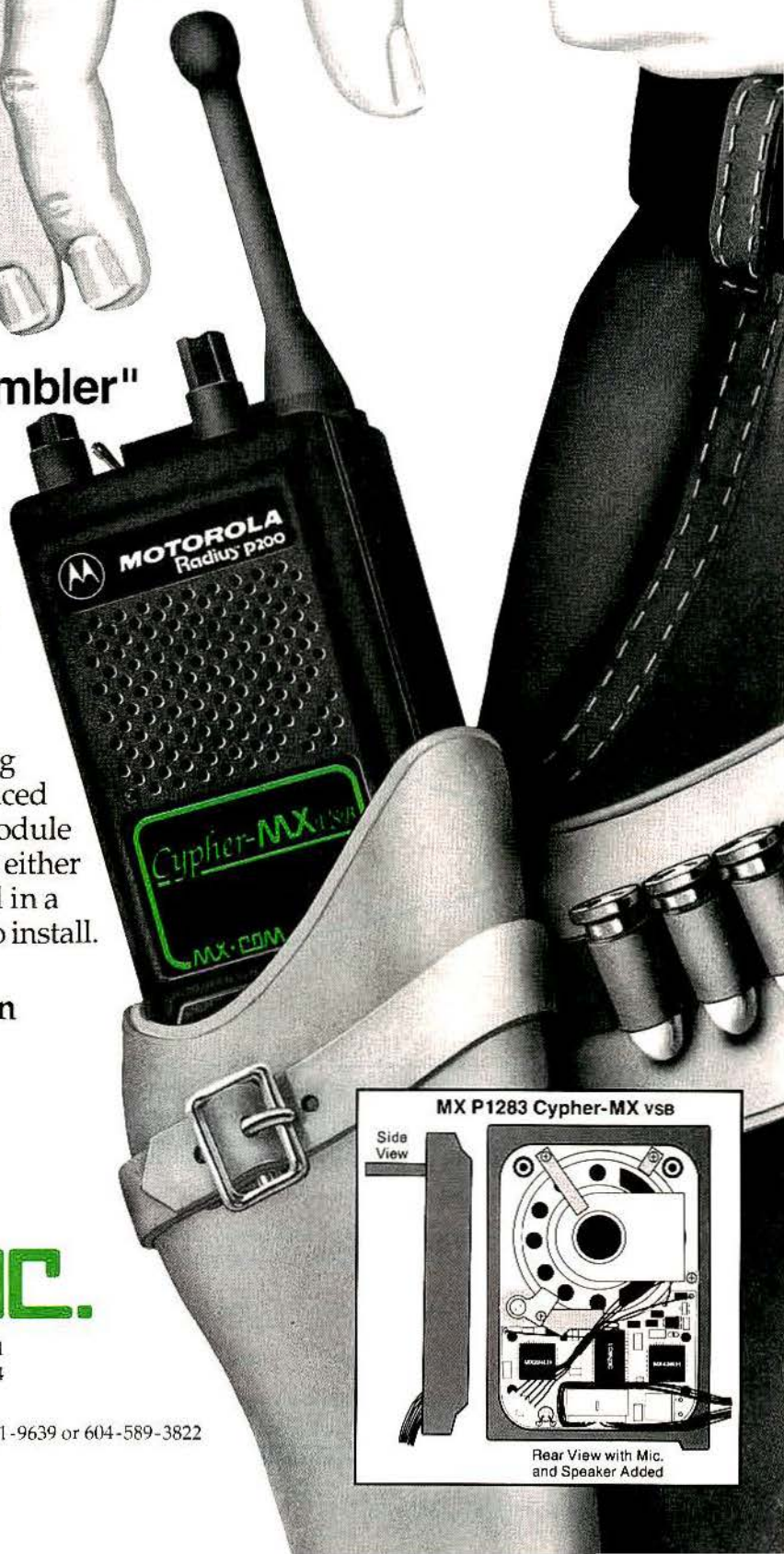
MX.COM, INC.

4800 Bethania Station Road, Winston-Salem, NC 27105-1201
In North Carolina Call: (919) 744-5050 or FAX (919) 744-5054

In Canada Call Omni Provincial Electronic, Inc.:
East / 514-648-8432 • Central / 416-841-6740 • West / 403-291-9639 or 604-589-3822

* Motorola and Radius are trademarks of Motorola, Inc.

Circle (7) on Fast Fact Card



Receiver bandwidth and the frequency-modulated signal

By Harold Kinley, CET

It is important that an FM receiver's bandwidth be wide enough to accommodate a fully deviated FM signal.

Unless the bandwidth is wide enough to accommodate the FM sidebands, severe distortion results. This distortion can cause squelch blocking on fully modulated signals.

Figure 1 below shows the instantaneous frequency excursions from the carrier frequency (f_c). Here, a 1,000Hz audio modulating tone (f_M) is

Kinley is a certified electronics technician with the South Carolina Forestry Commission, Spartanburg, SC. He is the author of *Standard Radio Communications Manual: With Instrumentation and Testing Techniques*, Prentice-Hall, 1985.

frequency-modulating the carrier at a deviation level of $\pm 5\text{kHz}$. If the receiver bandwidth were perfectly flat to $\pm 5\text{kHz}$ as shown by the box outline, it would appear that all of the modulated signal would fall within the receiver's passband. Not so.

FM spectrum

Unlike an AM signal, where, with single-tone modulation, there are only two sidebands, in an FM signal there are (theoretically) an *infinite* number of sidebands spaced on either side of the carrier at $f_c \pm f_M \pm 2f_M \pm 3f_M \dots$. This means that, for the FM transmission mode to be *distortion-free*, an infinite bandwidth is required.

Nevertheless, as a practical matter, it has been established that a low-distortion signal results with a band-

width containing only those sidebands that represent 98% of the unmodulated carrier power. Sideband *pairs* that represent at least 2% of the unmodulated carrier power are called the *significant* sidebands.

The formula known as *Carson's rule* for establishing the minimum required bandwidth for frequency modulation is:

$$B_W = 2(\Delta f + 1)f_M$$

where

B_W = bandwidth

Δf = maximum frequency deviation

f_M = modulating frequency

In his 1968 book *Communications Systems* published by McGraw-Hill, Bruce A. Carlson established the following formula as "... a better approximation for equipment design to determine 3dB bandwidth of RF and IF amplifiers ...":

$$B_W \approx 2(\Delta f + 2f_M)$$

Sideband power

The figures in Table 1 bottom left were taken from a Bessel function chart.

The table gives the voltage amplitude of all of the FM signal's *significant* sidebands relative to the unmodulated carrier-voltage amplitude when the modulation index (β) is 5.0.

The formula for finding modulation index (β) is:

$$\beta = \Delta f / f_M$$

Examine Figure 2 on page 64.

This graph illustrates the power distribution of at least 98% of the FM spectrum power given Figure 1's modulating conditions. The modulating tone (f_M) is 1,000Hz; the frequency deviation (Δf) is 5kHz; and the modulation index (β) is 5.0.

Notice in Figure 2 that *significant* sideband pairs extend out to $f_c \pm 6\text{kHz}$. If a receiver had a passband represented by Figure 1, the sideband

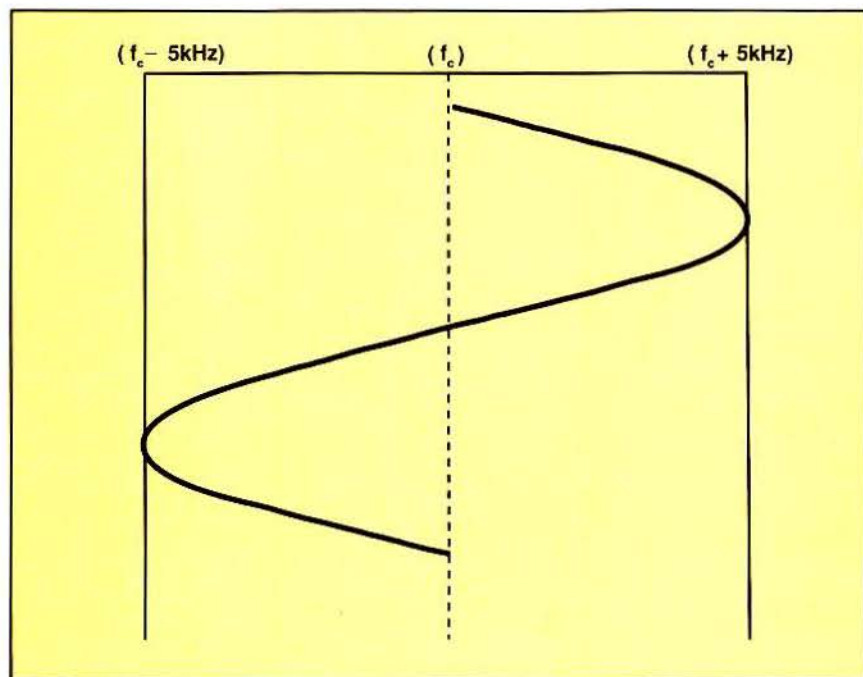


Figure 1. A 1,000Hz sine wave is frequency-modulating a carrier f_c at a deviation level of $\pm 5\text{kHz}$. The modulation index (β) is 5.0. The boxed outline represents the receiver passband. Notice that the *instantaneous* frequency excursions at the maximum and minimum points do not exceed the receiver's passband.

Table 1—The voltage amplitude of all of the *significant* sidebands of the FM signal relative to the unmodulated voltage when the modulation index is 5.0.

β	f_c	$f_c \pm f_M$	$f_c \pm 2f_M$	$f_c \pm 3f_M$	$f_c \pm 4f_M$	$f_c \pm 5f_M$	$f_c \pm 6f_M$
5	.1776	.3276	.0466	.3648	.3912	.2611	.131

(continued on page 64)

Save Your Batteries For When You Really Need Them.

Use X-Tra Talk, from Centurion.



Now you can make sure your batteries are ready when you need them.

It's simple. When operating from your vehicle, make it standard procedure to power

your two-way portable with X-Tra Talk (patent pending), the battery eliminator from Centurion.

X-Tra Talk plugs into your vehicle's lighter (or any other 12-volt source) to give you hassle-free operation for as long as you need to talk. No worries about power drain. No problems with related weakening of signal.

And best of all, no surprise battery failure down the line when you really need to use them.

Because X-Tra Talk gives you: • Maximum power output from your radio • Extended battery life • Protection against reverse polarity and current surges • Compatibility with virtually all popular two-way portables.

So why drain your radio's battery when you can tap into your vehicle's power source? Get X-Tra Talk and eliminate the frustration of batteries failing when you need them most.

X-Tra Talk. Another bright idea from Centurion, your two-way portable power source.

Call us toll-free at 800-228-4563 for the name of our distributor nearest you. And ask about our full line of batteries and power packs.



CENTURION INTERNATIONAL, INC.
Power When You Need It.

How to construct towers for performance, safety, stability

Constant, consistent coverage assures mobile radio communications service customers of continued service. Choosing the right tower for the mobile radio base station site helps to meet the service priority.

By Fred Moore

Tower leg construction and other support mechanisms should be considered when buying a radio communications tower.

Most commonly, the three choices for tower leg construction are solid-leg, tubular and angular. Mobile radio system operators concerned with cost

and the value of their equipment, which may be attached to a tower, need to be aware of tower construction options to make an informed selection.

Table 1 below compares the relative performance of the three tower types.

Advantages and disadvantages

Solid and tubular legs have different advantages than angular legs for mobile radio tower construction. Solid and tubular legs have a lower wind load and more efficient cross-sections. They can be manufactured in many sizes.

Solid legs limit corrosion to the outside of the leg where it can be seen easily.

A tubular leg, though, may corrode from the inside. The corrosion is not discovered until it erodes to the outside of the leg. This corrosion can result from condensation or from debris that is blocking a weep hole or a drainage hole, where water may accumulate.

In cold climates, the water turns to ice that can crack or split the leg.

Splitting is rare, and corrosion is not

Moore is vice president of FWT, Fort Worth, TX. He specializes in communications towers.

Table 1—Relative performance comparisons for solid-leg, tubular-leg and angular-leg towers

PERFORMANCE MEASURE	SOLID	TUBULAR	ANGULAR
Overall tower sway	1.0x	1.35x	1.17x
Wind resistance (area exposed to wind)	1.0x	1.64x	3.64x
Vulnerability to rust (percent of member that is lost if 1/16" rusts away)	9%	37%	29%
Freezing water	Not an issue	Possible to get trapped, freeze and split leg	Not an issue
Price comparison (based on several tower designs)	100%	100%	115%

Source: Paul J. Ford & Company Engineering, Columbus, OH.

Scenario: 100kip load on 36ksi steel with a 5-foot unbraced length. Shape factors are 0.6 for rounds and 1.0 for flats. Comparable-strength members were selected to compare the performance features of solid-leg, tubular-leg and angular-leg steel towers. The table illustrates the performance characteristics of 2.75-inch solid-leg, 4.5-inch outside diameter x 0.337-inch tubular leg and 6-inch x 6-inch x 7/16-inch angular-leg towers.

kip = 1,000 pounds

ksi = 1,000 pounds per square inch



THE PERFECT '10'

You've been wanting a 10 dBd antenna that really delivers 10 dBd all the way across the band. One that covers the entire 806-960 MHz range in 3 bands, allows for duplex cellular operation and has 1500 Watt power capability. We listened, and now you have one. The Celwave PD10183.

It's the top performing, pattern constant throughout the band, 187 mph wind beating, transposed dipole array, copper radiating elements enclosed in a rigid fiberglass radome, omnidirectional



stroke of genius that won't punch holes in your system.

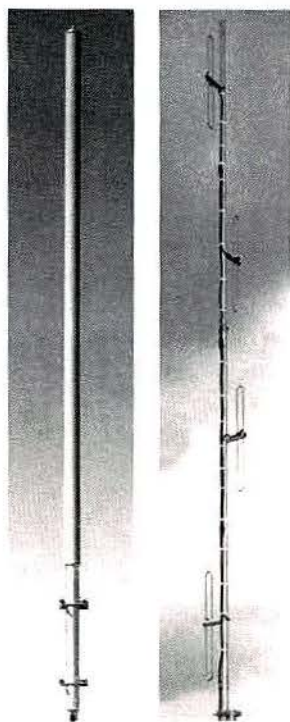
Whether you mount it upright or invert it, electrically downtilt it or add a directional reflector, anything less than a PD10183 is less than perfect.

CELWAVE 

DIVISION OF RADIO FREQUENCY SYSTEMS

Celwave, Route 79, Marlboro, NJ 07746
(908) 462-1880 • (800) 321-4700

TOP TO BOTTOM QUALITY ANTENNA SYSTEMS



VHF, UHF and 800MHZ
Base Station Antenna Systems



HELIAX® Coaxial Cables
& Connectors

**Available
Directly From
Stock**

CALL 305-846-1011

Marketronics
CORPORATION

One of the World's Leading Distributors of
Quality Telecommunications Equipment

TOLL FREE IN USA: 1-800-845-1230 FAX: 305-846-1672

320 INTERNATIONAL PARKWAY SUNRISE, FLORIDA U.S.A. 33325



likely to occur for many years after installation. But because the cost of solid-leg and tubular-leg towers is similar and the repair cost of a split or corroded leg is an additional expense, the solid-leg tower often is preferred.

Records show that solid-leg towers resist damage during construction and antenna-mounting far better than tubular or angular towers.

Disasters that most often affect towers include tornadoes, hurricanes, gale winds and ice storms. Careful calculation and early preparation can help to prevent such disasters from causing irreparable damage to a mobile radio tower and the equipment it supports.

Tower selection plays a role in di-

*Tower selection plays a
role in disaster
preparation. Solid-leg
towers sway less during
wind and earth
movements. Excessive
swaying can damage or
destroy a tower.*

saster preparation. Solid-leg towers sway less during wind and earth movements. Excessive swaying can damage or destroy a tower.

An on-going maintenance program to keep the tower in top condition is important, too.

To cope with the aftermath of a disaster, a disaster recovery plan should be prepared. By following the plan, a mobile radio system operator can repair a damaged tower more quickly or deploy and install a new tower rapidly. Down time represents a loss of income from daily operations.

Flexibility in design is a key element in expanding a tower's use.

Incorporate maximum antenna loads into the tower design. If a tower is not designed for a growing load when it is

BEST



MORE FEATURES AT
LOWER COST . . .

**FCC/
DOC
APPROVED**

- Built-in programming keyboard and digital display assure trouble free set-up. No computer or computer knowledge required.
- 90 Number Speed Dialer
- Last Number Redial
- Hookflash
- User programmable CW Identifier
- Automatic busy signal/dialtone disconnect
- Ringout: sounds like a telephone
- Regenerated DTMF or pulse dialing
- COS Input: allows Carrier, CTCSS or DPL operation
- Resettable call limit and activity timers
- Line in use detection/call waiting
- 1-800 toll override
- Toll restrict
- DTMF signaling AND MORE

MODEL 8200: Full or Half Duplex Interconnect, Repeater Maker, Remote Base, Paging, and Selective Calling.

MODEL 9800: Vox Control Station (EVD optional) or Half Duplex Interconnect, Repeater Maker, Remote Base, Paging, and Selective Calling.

Land to mobile and mobile to mobile signaling options (both models):

- 2 tone 1000 call
- 5/6 tone 1000 call
- CTCSS 38 call

Phone
Patches
In The
Business

!



Connect Systems, Inc.

2064 Eastman Ave., Suite 113, Ventura, CA 93003

Turn your two-way system into a phone system today! **CALL 1-800-545-1349 • FAX (805) 642-7271**

Circle (11) on Fast Fact Card

IN CANADA:

CARTEL (800) 663-0070
EASTCOM (416) 850-2550

INTERNATIONAL:

JESCOM (415) 574-1421

constructed, frequently it cannot be upgraded without significant additional cost.

It is not a good idea merely to increase antenna loads without first estimating the loads' effects on the tower. It is much more accurate and safe to estimate anticipated future loads during initial tower design, ensuring that the tower has growth capacity.

A solid-bar tower supports an increased load more effectively compared to tubular-leg and angular-leg towers. On the other hand, for lighter loads and little or no anticipated growth, a tubular-leg or angular-leg tower may be appropriate.

Mill specifications

When purchasing a tower, always ask for mill certifications to confirm that the tower is constructed of steel with the strength specified by the engineering design.

It is common to construct towers with high-strength steel. Yet, the highest-strength steel may not be the

best choice because the higher the strength, the more brittle the steel.

Determining wind and ice load is critical to designing a stable tower.

Here are some comparisons of relative steel strength:

<u>STEEL STRENGTH</u>	<u>COMMENT</u>
36ksi	Lower strength
50ksi	Best
65ksi	High strength, but too brittle
ksi = 1,000 pounds per square inch	

Some manufacturers may state that high-strength steel is better than a standard 50ksi steel. Actually, the high-strength steel—65ksi—is more brittle.

Using high-strength steel allows the manufacturer to reduce the size of the steel members, which saves money, but the reduction allows more tower sway.

Determining wind and ice load is critical to designing a stable tower.

Be sure all vendors use the same wind and ice load in their calculations. The Electronic Industries Association (EIA) wrote guidelines for uniform, standard tower design. These standards are based on the American National Standards Institute publication ANSI A58.1, which serves as a guide for most building codes.

The EIA standard specifies a minimum design wind velocity on a county-by-county basis, but it does not make recommendations regarding radial ice accumulation. Specific areas, such as the Great Lakes coastline and Rocky Mountain peaks, are considered

Caller ID. Their number's up.



Digital ANI

Introducing CSC's ID-33 Encoder for Automatic Number Identification—

This state-of-the-art, subminiature ANI board will stop the horseplay and end the stuck mikes. It includes a time-out timer and emergency/status messages as well as ANI; transmits the ID in a mere 100 milliseconds. Fleet prices from \$69 to \$121. Call for brochure.

CSC CONTROL SIGNAL CORPORATION

1985 S. Depew St. #7 Denver, CO 80227 (303) 989-8000

CALL TOLL FREE 1-800-521-2203

Circle (12) on Fast Fact Card

R-2600



All that test equipment you've been using, with its endless cabling and "we mean business" knobs and switches, has served you well over the years. But someday you're going to need to replace it. That someday is today!

Digital testing is a reality; Cellular testing is big business; Software-driven testing is the future, and it's all available now in one box... the R2600 from Motorola.

The R2600 can provide:

- 1GHz Signal Generator
- Sweep Generator
- Duplex Offset Generator
- AC/DC Voltmeter
- Sensitive Off-the-Air Receiver
- Audio Generators
- AF & RF Counters
- Full Screen Spectrum Analyzer with Audio
- SINAD & Distortion Meters
- Terminated Wattmeter
- Signalling Simulator & Decoder
- Signal Strength Meter
- Full Screen Digital Oscilloscope
- 50 MHz Tracking Generator Option
- Cable Fault Option
- Subscriber Unit & Cellular Base Station Test Options

The R2600 features: 30 Test Set-Up Memories; Built-in Self Calibration; RS-232 Remote Control; Operator Selectable Special Functions; Help Screens; and a Color Monitor Port. Easy to use, easy to setup, transportable, intuitive to operate, economical, and upgradeable.

Call **1-800-235-9590**

or call (602) 441-8676, or write:

P.O. Box 2606 - M/D H3170 - Scottsdale, AZ 85252

™ MOTOROLA is a trademark of Motorola Inc.
© Copyright 1992 Motorola Inc.



MOTOROLA

special wind regions for which the EIA makes no wind velocity recommendations.

The burden of choosing the correct design wind velocity and ice accumulation lies with the tower purchaser.

The EIA standard cautions that "very tall towers may experience large thicknesses of in-cloud icing over portions of the mast." If the purchaser does not

specify ice accumulation, this critical design consideration may be ignored by some tower manufacturers in this highly competitive market.

In most locations, the maximum design wind velocity and ice accumulation do not occur simultaneously. For this reason, the EIA standard allows a 25% reduction in wind load when ice is considered. This wind load reduc-

tion often is considered automatically by tower manufacturers unless the tower purchaser specifically states that the maximum wind and ice should be considered to occur *simultaneously*.

Assessing the choices

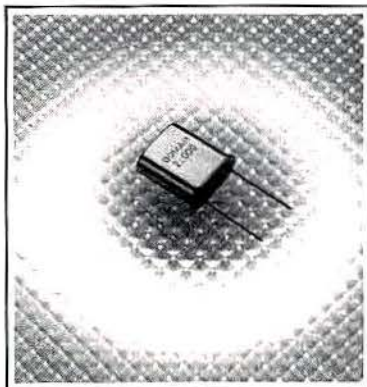
Foremost, seek a vendor with experience in manufacturing mobile radio towers.

That experience should extend to all areas of tower construction. Seek vendors that have been in the business at least 20 years. Find out how much of that experience is with tower construction specifically.

A tower manufacturer should offer all three options in member construction: solid-leg, tubular-leg and angular-leg. Flexibility is important in

Yo, Aged Crystals.

Bomar Crystals are 100% aged to exact specifications for totally clean, drift-free reception. Even 48-hour emergency crystals are precisely aged, or Quality Control won't ship them to you. Aging stops crystals from drifting. Adds stability which maintains the frequency you specified—not for months but years. Bomar's high-performance crystals won't drift .001 per cent in one year. We guarantee it. We also guarantee our crystals will outlive the life of the radio. Yo, check it out.



BOMAR

201 Blackford Avenue
Middlesex, N.J. 08846

TOLL FREE FAX:
1-800-777-2197

CALL TOLL FREE

1-800-526-3935

Visit us at IMCE, Booths 405 & 407.

Circle (14) on Fast Fact Card

In most locations, the maximum design wind velocity and ice accumulation do not occur simultaneously.

meeting customer needs. Although the advantages of solid-leg tower construction are clear, a customer should have the option to choose what he perceives as most appropriate for the application.

Inquire about the effect that last-minute changes to the design have on the cost. Such changes do not necessarily have to mean cost increases.

Final considerations

Because constant service and air time are a priority, purchasing a reliable tower for long-term use is an important decision.

Safety and site considerations are important factors in mobile radio tower erection. Stability and load planning can affect the tower's useful life.





ANTENNA CATALOG

MAXRAD
State of the Art Antennas

MAXRAD, Inc.
4350 Chandler Drive
Hanover Park, IL
60103 USA
Order: (800) 323-9122
Voice: (708) 372-6800
Fax: (708) 372-8700

Circle (15) on Fast Fact Card

♦♦♦ **Follow the Leader**

Aluminum towers fit light-duty applications

Temporary radio communications antenna installation requirements may be met with light-duty aluminum towers. Trailer-mounted portable towers can support communications at emergency locations.

By Don Bishop
Editorial Director

Agencies and radio shops that must provide emergency and temporary radio communications sometimes can use light-duty aluminum towers, including crank-up and portable mod-

may fit some applications better than their heavy-duty, steel counterparts.

T.E. Gottry, vice president of Aluma Towers, Vero Beach, FL, sells the bulk of his products to radio communications equipment dealers and users, cellular telephone carriers and government agencies. For example, the Federal Emergency Management Agency

Gottry explained. "Citrus workers use big, heavy ladders to pick fruit from the trees. Somebody decided to make harvesting easier—and possibly to extend the workday by reducing the pickers' fatigue—by making a lightweight aluminum ladder. After 10,000 feet of various sizes of tubing were purchased, safety officials blocked the project:

'No way are you going to use aluminum ladders in orange groves with the lightning problems we have in this state,' they said.

"So the man had 10,000 feet of aluminum tubing he didn't know what to do with. His father was an amateur radio operator, and that led him to design a 3-section tower instead. The lighter section fit home TV reception applications. The other sections, put together as a 2-section tower, fit amateur radio applications. Thus, a need to dispose of the otherwise useless tubing got the business started back in the mid-'60s," Gottry said.

The 15 current tower models are assembled from four standard sizes of sections. The tallest, a 100-foot tower, is made of four 25-foot sections.

The welds, such as the one shown in Photo 2 on page 20, show gaps. Gottry explained why.

"First, if we tried to close that weld all the way up, it would pressurize the tube and blow one of the welds out continually. You'd get a blowout because of the expansion of air trapped



Photo 1. Trailer-mounted towers support antennas used for emergency and temporary radio communications.

els, to support antennas. (See Photo 1 above.)

Most aluminum towers currently manufactured may not meet load-bearing and height requirements for permanent communications sites, but with their portability, light weight and ease of installation, aluminum towers

uses portable aluminum crank-up towers on some of its radio communications vans, as do state, county and local public safety agencies.

Gottry has managed the company since 1974. The company originated as a ladder-manufacturing project. "Florida has a lot of citrus groves,"

Real Pagers for a Real World.



Today's pager customers come in all shapes and sizes.

They include plumbers, and business people and moms. Just regular folks who don't like being out of touch.

And when it comes to choosing pagers, they're looking for qualities that fit these practical times.

Like the ability to get the job done, without expensive gimmicks. And the solidness to endure the bumps and bruises of

a not-so-perfect world.

At Uniden, we've always designed our pagers with the real world in mind. So it's no surprise that as pagers become part of everyday life, Uniden is fast becoming the people's choice.

If you want to sell pagers to the no-nonsense customers of today, stock the pagers designed with the real world in mind. Uniden pagers.

uniden®

© 1992 Uniden America Corporation

For more information about Uniden Pagers, Call 1-800-292-2294.
Circle (16) on Fast Fact Card

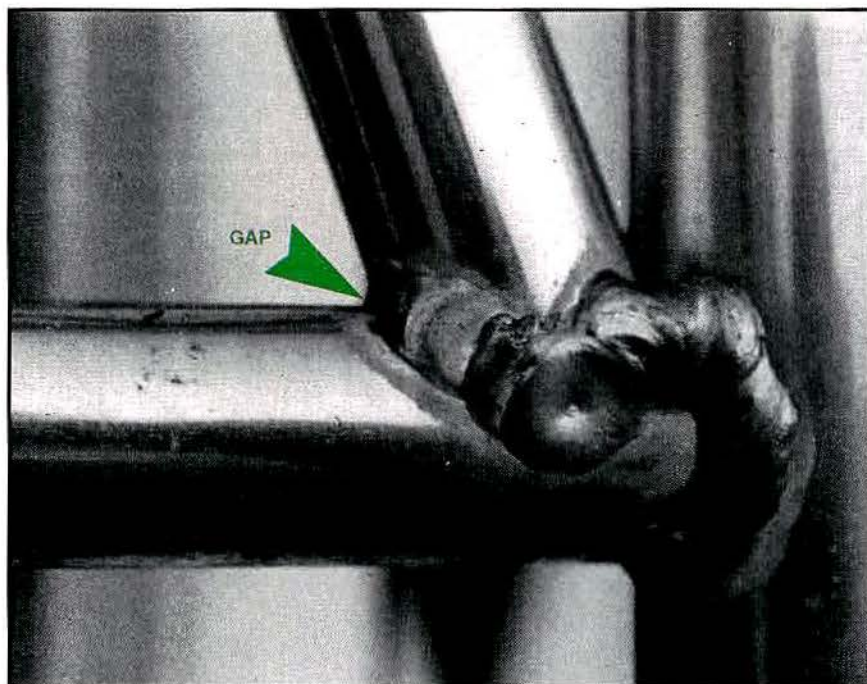


Photo 2. Tower welds have gaps because a closed weld would pressurize the tube and blow out one of the welds. Gaps do not weaken the weld because the welded joint is stronger than the tubing it joins. Welding is done via the tungsten inert gas (TIG) process.

inside the tube. There is such a tight fit, the way we cut and notch the tube, that if one weld were closed, another would blow out.

"Second, the welded joint is stronger than the tubing it joins. If the joint were heated too much more, the heat would soften the tubing."

Welding is done via the tungsten inert gas (TIG) process. A non-consumable tungsten is the welding electrode. A filler rod of aluminum provides material for the weld. "The process is much like brazing," Gottry explained. "You're melting the rod with the tungsten, and you're feeding the rod with your other hand."

The other type of aluminum welding, MIG, is used on occasion to produce welds on trailers built to carry portable towers. "With MIG, you feed the wire through and the wire becomes the electrode," Gottry said. "MIG welding is faster, and it is used with thicker metals. It produces a less attractive result, so the MIG process is not used for the towers."

STI-CO

DUAL BAND

NEW from STI-CO—**THE FIRST DISGUISED CELLULAR LOOK-ALIKE ANTENNA** that is both **DUAL BAND (VHF/UHF)** and **BROADBAND!**

The **EF-150/450 ANTENNA** looks exactly like an ordinary elevated feed style cellular antenna, **but covers 24 MHz bandwidth in VHF and 20 MHz bandwidth in UHF.**

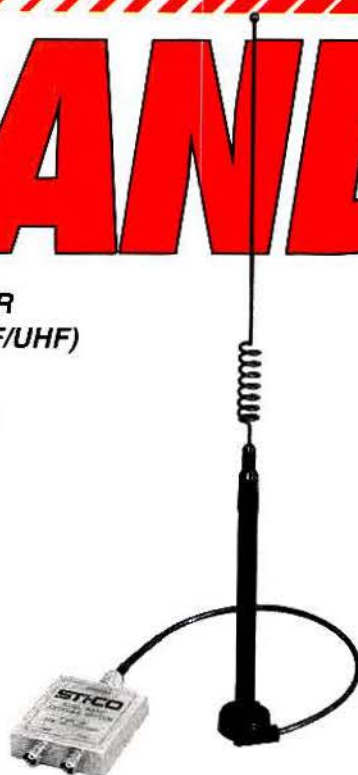
Available in roof and trunk lip mounts.

More great coverage from

THE
DISGUISE GUYS

STI-CO INDUSTRIES, INC

11 COBHAM DRIVE ORCHARD PARK, NY 14127-4187 (716) 662-2680 FAX -5150



Circle (17) on Fast Fact Card

Put MAXON to work for you!!

RESUME Maxon America, Inc.

Objective:

To continue the design and manufacture of high quality, affordable products for the Land Mobile Radio, Paging and Telemetry/Data markets.

Experience:

1974 - 1981: MAXON MANUFACTURES ELECTRONICS!
Home stereo equipment, citizen's band radios (we are currently one of the two largest manufacturers in the world!) and cordless telephones.

1982: Maxon introduces its first FM two-way business radio (we are currently one of the in a compact "slim profile" case (we patented the case design). This 5 watt/4 channel VHF portable is the smallest on the market! A full line of accessories were also announced.

1984: Maxon introduces the CP-0520, a UHF version portable. Additional introductions this year — models CS-0510 and CS-0520 (the "CS-Series"), featuring a hi-low power switch which selects 1 or 5 watt power output... adding a battery saving feature to a Series that still serves the field today!

1986: Maxon enters the telemetry/data market with the DM-0500 Series radio. Three distinct models offer transmit/receive, transmit-only, and receive-only versatility.

1988: Maxon goes synthesized (and mobile)! The SM-4150 is a 40 watt power house! With 16 programmable channels, and user friendly controls — this mobile will remain a favorite for years to come! Did we mention it took the "Most Innovative New Product" award when introduced to the market?

1991 - 1992: The SP-2000 Series (models SP-2850 VHF and SP-2850 UHF) synthesized portables offer a 1/5 watt power switch, and 10 programmable channels. This Series performs! The UHF synthesized mobile — model SM-4450 is released. PAGING? YES! The ND Series pagers (models ND-15, ND-45 and ND-90) bring us into another aggressive market. These VHF, UHF and 900 MHz units continue to enjoy strong sales!

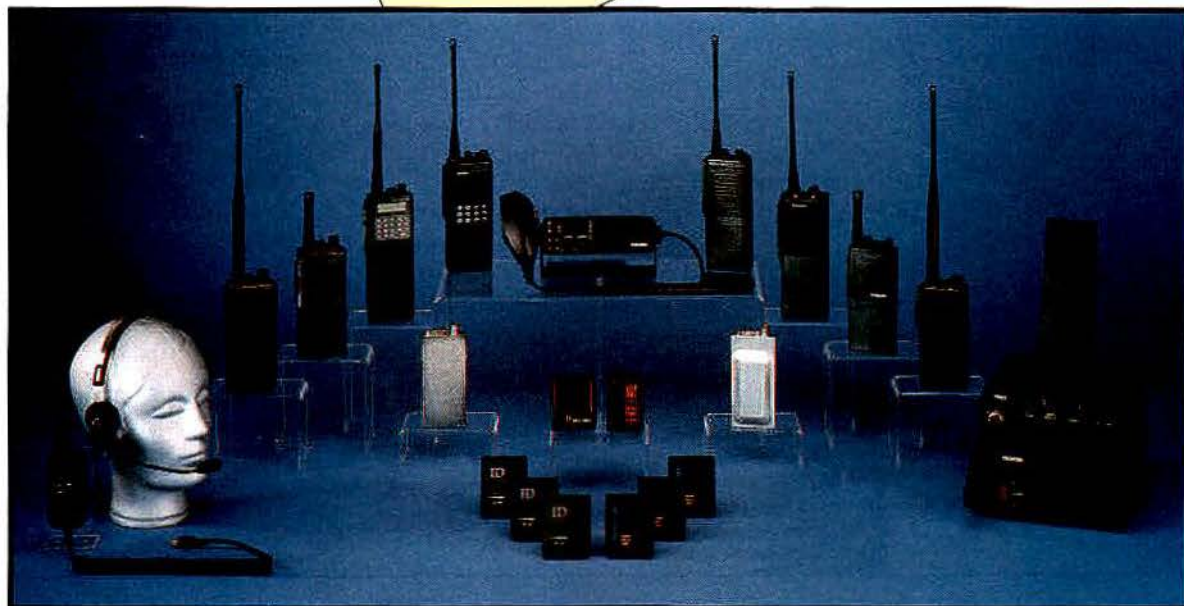
1993 and beyond:
Trunking repeaters, trunking portables, innovative LMR products, advanced data and paging products!

References:

Business and industrial applications, state and local police departments, fire departments, U.S. Embassies, emergency medical services, security organizations, drug enforcement agencies, etc. — OR — Call your nearest Authorized Maxon Dealer or MAXON at 1-800-821-7848. (In Missouri, call 816/891-6320).

maxon®

A World of Communications



Maxon America, Inc. 10828 NW Air World Drive Kansas City, Missouri 64153 816/891-6320, Fax: 816/891-8815



Photo 3. Some tower bases are hinged so the tower can be tilted over. One person can 'walk down' a light-duty tower.

He said gaps in the tower welds have nothing to do with moisture drainage. "Only a small bit of condensation can get in," Gottry said, "and it has not been a problem." In addition, the tower legs normally are not sealed at the base. Usually, they are supported above a concrete slab on a mounting base that allows the legs to drain.

Tower bases

Most of the towers have bolted bases instead of having legs that extend into concrete. The towers are not truly free-standing. Normally, they are attached to an adjacent building by a bracket at eight feet above ground. Even the short towers normally have a bracket or guy wires, so they do not require massive concrete foundations. A small pad, two feet or three feet square and a foot or so deep, serves in frost-free parts of the country. "At colder latitudes, the base should extend below the frost line so it won't heave in freezing weather," Gottry said.

Some of the bases are hinged so the

TAIT base stations— as reliable as gravity.

An apple started Newton's thoughts on gravity's reliability. TAIT believes that base stations and repeaters should deliver that same sort of reliability. Our two-year warranty reflects that belief. Do others measure up?

🍏 **Apples are equally easy to maintain**—just a polish now and then. TAIT modular radios, using industry-standard components, are no problem for any experienced tech.

🍏 **Apples are discrete**—no interference. TAIT adheres to the highest noise immunity standards in the industry; standards radios built *only* for the U.S. can't meet.

🍏 **Apples are compact**—with high value. Where other systems are refrigerator-size, we put a briefcase handle on TAIT repeaters. Call for more on:

**Radios reliable as
gravity in 80 countries**

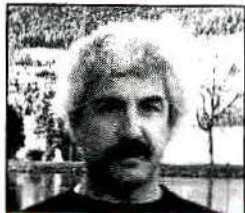
1-800-222-1255

Fax: 713/468-6944

©1992 TAIT Electronics.

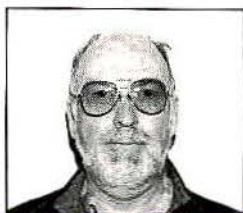
Circle (19) on Fast Fact Card

“And You Can Quote Me”



Phil Licciardi
Radio Communications, Inc.

"I never have a problem with products, or shipping response time."



Donald Rich
Z-Way Mobile Radio

"Your sales people are always very helpful and I get what I need in short order; this saves me money and I can serve my customers better."



Barb Hoover
Troup Electronics

"Over the years we have tried other suppliers but have always stayed with Cartwright. There are never any hassles when we need to return products for any reason."

Cartwright customers can be counted on to speak up when asked for their opinion.

Periodically, we ask our customers to tell us how we're doing. The whole truth and nothing but the truth, whether it's "good, bad or ugly". Here's a sampling of their comments. And in each case, they said, "You can quote me".

We Deliver Value!

1-3 Day Delivery Nationwide. Call us by 3:00pm E.T. and we'll ship the same day.

Call for our free Pricebook with guaranteed prices for 3 months.



CARTWRIGHT
COMMUNICATIONS COMPANY

800-543-8614

**Your ready source for Andrew, A/S,
Celwave and Decibel Products.**



Douglas Miller
Mid State Electronics

"Excellent inventory on everything we've needed and you ship out very quick. Thank you for the good service, keep it up."



Andrew Samo
Communications Unlimited

"Your sales people are very helpful in finding even small items that can't be found elsewhere."



Roger Boggs
Krug International

"All your folks have been really helpful. Thanks for being there, and thanks too for having a 800 number."

tower can be tilted over. (See Photo 3 on page 22.) "One person can 'walk down' a light-duty tower," Gottry said.

Bases for the heavy-duty towers are more rugged, and a base with rods that can be mounted into concrete is offered.

Plastic rollers

Short sections of polyvinyl chloride

(PVC) tubing are fitted over some of the cross-braces in crank-up towers to serve as rollers that reduce friction as one tower section passes another. When towers are shipped to extremely cold climates, the PVC rollers are replaced with aluminum rollers. "PVC would become too brittle and shatter in extreme cold," Gottry said.

The PVC rollers are long-lasting.

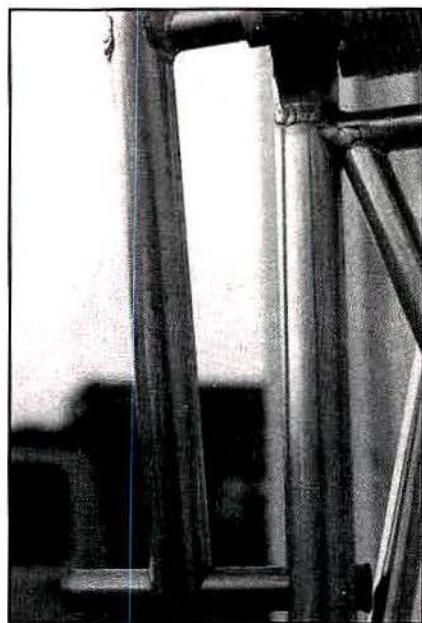


Photo 4. There are two ways to lock the tower. The first is to position the hand crank as shown and lock it in place with a bicycle lock.

Now, a two-way line you can count on.

Count on Mobile Mark to come up with this new, economical two-way antenna: shown with a black-chrome base and a 1/4 wave whip. Available for 140-950 MHz.

It's just one dependable part of our new roof and body mount antenna line that includes UHF, VHF and Low band antennas.

All are engineered for outstanding performance, and backed by solid sales support and warranty.

Count on Mobile Mark for continuing service long after the sale, too. Our 43-year reputation for responsive service is unequalled in the mobile communications industry. Call today.

1

Quick Disconnect Mechanism lets the whip come off easily.

2

Spring Loaded Center Contactor means quality reception that lasts.

3

Neoprene O-Ring Seal effectively keeps moisture out of the connection.

MOBILE MARK
COMMUNICATIONS ANTENNAS

3900-B River Road, Schiller Park, IL 60176 800-648-2800 or 708-671-6690

"We've been building the towers since '74. Among the towers we've gotten back, the rollers have shown no deterioration. We have yet to find the PVC's life," he said.

"We install aluminum rollers when somebody wants to put a finish of some type on the tower, such as powder coating or paint," Gottry continued. "Then the tower can be baked or anything else can be done to it without worrying about having plastic rollers that would interfere with the baking process or powder coating."

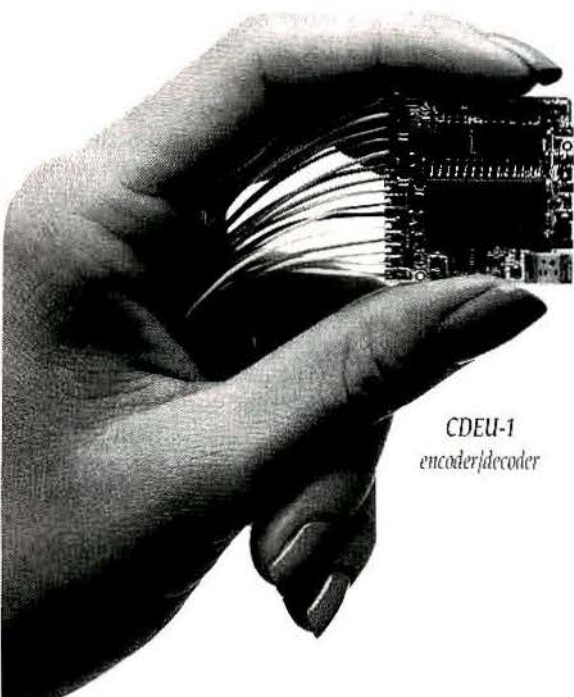
There are two ways to lock the tower. The first is to position the hand crank as shown in Photo 4 above. "You could lock that with a bicycle lock," Gottry said.

A safety stop engages at the conclusion of the crank-up process. "You raise the tower to the desired height, then bring it back down slightly," Gottry said. "The safety stop engages, allowing one of the inner rungs to rest on it."

A nylon rope controls the safety stop, and a stainless-steel cable bears the load. (See Photo 5 on page 26.) A pull on the rope disengages the stop. "A lot of people remark about the two lines," Gottry said. "They both reel up nicely. We never get a backlash or rat's nest with any of this. Depending on the

Man Down, Radio Kill and Remote Mic Monitor

It's easy with two-way ANI products from Cimarron Technologies.



CDEU-1
encoder/decoder

The CDEU-1 subminiature ANI encoder/decoder gives virtually any portable or mobile radio two-way digital signalling capability. Easily installed in your radio, it provides advanced features found in no other GE-STAR® compatible product:

- Remote Radio Kill & Un-kill with acknowledgement
- Timed Open-Mic-Monitor with ack
- Selective Unit, Group & All-Call with alert tone & LED
- Emergency & timed Man Down with ack & alert tone
- Remote Unit Radio Check with ack
- ANI at the beginning, end, or both
- Stuck-Mic & Time-Out-Timer with ack & alert tone
- Automatic data muting
- Fully field-programmable with over 30 parameters
- 3 year no-hassle warranty

And at the dispatch center, your remote radios are displayed and controlled by our C-MARK series of two-way dispatch displays (with optional desk top terminal). Some of the special features include:

- User-defined alphanumeric ID's
- Full two-way data handshaking
- Large, easy to read displays
- RS-232 printer output
- Battery-backed time & date clock
- Automatic data muting
- RFI shielded enclosure
- 19" rack mountable
- 3 year no-hassle warranty



C-MARK IV Dispatch Display (above) and the **CDT-1** desk top terminal (right) work together to display and control your remote radios from the dispatch center.

To find out more about Cimarron's complete line of GE-STAR® compatible ANI products, call toll-free in the U.S. 1-800-487-7184, or (619) 738-3280

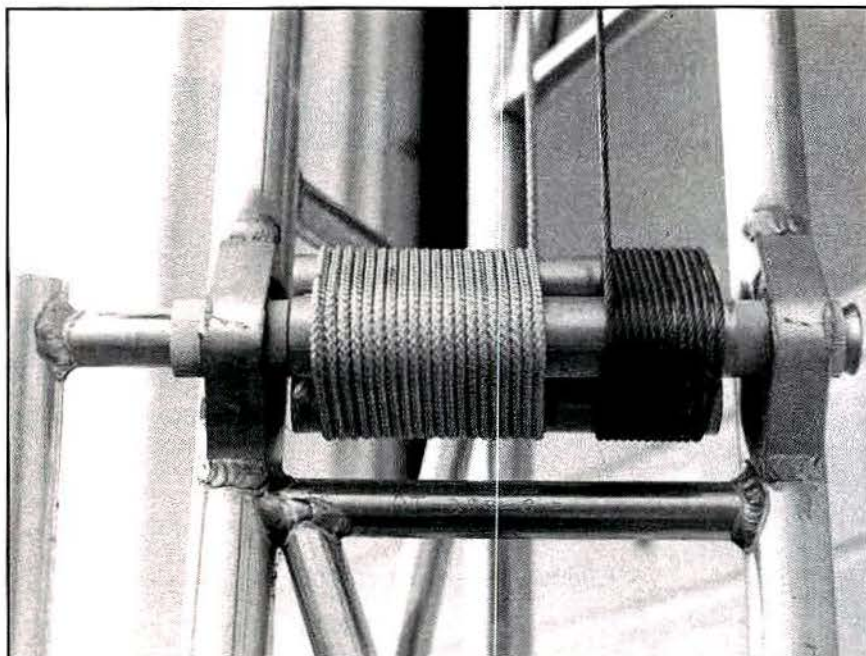


Photo 5. A second way to lock the tower is to use the safety stop that engages at the conclusion of the crank-up process. The tower is raised to the desired height, then brought down slightly. The safety stop engages, allowing one of the inner rungs to rest on it. A nylon rope controls the safety stop and a stainless steel cable bears the load. A pull on the rope disengages the stop.

conditions it is subjected to, the nylon cord needs replacing in five or six years because it loses tension."

Cleaning a tower

Cleaning a used tower or one that has been stored under dirty conditions is simple. Gottry retrieved a 10-year-old tower when its owner converted from over-the-air to cable TV reception. "We took the tower to the car wash, hosed it and waxed it. It didn't look bad at all."

Chemical solutions can be used, too. Gottry said Alumibright is among the two or three solutions with which he is familiar. He said Alumibright contains sulphuric or hydrochloric acid, and warned that the solution etches the aluminum and removes its shine.

About the only displeasing aspect of the tower is its tendency to turn light gray or milky white from oxidation in ordinary weathering conditions. The oxidation is harmless, but it will transfer from the tower to hands and clothes.



Here-and-Now Service for Way-out-There Business

Out there,
beyond the
reach of wire,
Zetron's
Extend-A-Line
brings you
inexpensive
Rural Telephone
Service
for phone, fax,
and modem.

- Excellent audio quality - sounds like a telephone
- Works with FAX machines and modems
- May call up to 10 remotes and up to 10 base units
- Compatible with tone and pulse telephones
- DID version for connection to paging terminal

Call today for more
information on the Model 72
Extend-A-Line

ZETRON

12335 134th Ct. N.E. Redmond WA 98052

Phone: (206) 820-6363 Fax: (206) 820-7031

Circle (23) on Fast Fact Card

Take A Look At Our Brass

After a Cushcraft/Signals antenna has been installed, you won't see the UltraLink Cable,TM the all-brass mount or the silver-plated contacts. Quite simply, you won't see some of our best work.

With UltraLink Cable, installs are fast and easy. It snakes great and the connectors fit right. The Teflon[®] core makes it the best cable for high temperature applications. Its low-loss characteristics will allow more of the signal to reach the antenna. Our all-brass mount won't corrode so it's easy to remove. Larger teeth and a soldered lug insure an excellent ground.

When the world's largest package delivery company needed antennas for their parcel tracking system, they chose the one you see here. Make the informed move to Cushcraft/Signals for all your demanding mobile applications.

Call us or your favorite distributor for your mobile and base antenna needs.

UltraLink CableTM



- Low-loss Teflon[®] dielectric
- Withstands high temperature
- Fits standard RG58 size connectors
- Easily removed dual shields
- Solid center conductor

All-Brass Mount

- Non-corroding
- Parts won't seize together
- Large grounding teeth
- Soldered ground lug

Cushcraft/Signals
supplies a complete line
of base and mobile antennas.

1-800-258-3860

FAX: 1-800-258-3868

cushcraft/Signals

48 Perimeter Road, Manchester, NH 03103 U.S.A. • Telephone: 603-627-7877 • FAX: 603-627-1764 • TELEX: 4949472

Circle (24) on Fast Fact Card

Use a unified approach for lightning protection

Effective lightning protection combines bonding and grounding, transient voltage surge suppression and structural lightning protection into a unified system designed to safeguard all of your equipment.

Effective lightning protection

Bonding and grounding

- ☐ Bond all electrical, electronic and metallic masses with conductors so they are at the same electrical potential.
- ☐ Connect the shelter bonding system so the site equipment connects with the grounding system at one point.
- ☐ Ground the tower with a low-impedance system.
- ☐ Ground the shelter and surround it with a buried counterpoise.
- ☐ Ground electrical and wired communications services with a low-resistance ground.
- ☐ Tie the three grounding subsystems together.

Surge suppression

- ☐ Do not rely entirely on lightning arrestors. Use transient voltage surge suppressors to provide protection from phase wire to ground wire to neutral wire to phase wire, limiting the difference in electrical potential among all wires in the system.
- ☐ Limit surge suppressor leads to an ideal length, preferably less than 12 inches.
- ☐ Use staged protection to solve the problems of let-through voltages and of surges induced electromagnetically into the electrical wiring inside of the primary surge suppressor.
- ☐ Select suppression products that have been tested and rated as complete units.

Structural lightning protection

- ☐ Reduce the number of times the radio site and tower are struck by lightning by installing a static ground charge dissipation system.

By Bruce A. Kaiser

Looking for something to do during short, warm-weather nights? Try this summertime delight:

Take multiple sections of structural steel; allow to rise for several days.

Ground well.

Garnish around base with sensitive electronic equipment.

Best when served accompanied by bright flashes of light and loud noises.

Sound like a recipe for disaster?

In many cases, it is. But it does not have to be.

Effective lightning protection is a 3-part proposition:

- ▶ bonding and grounding.
- ▶ transient voltage surge suppression.

- ▶ structural lightning protection.

Each element is critical. Without all three, a site is not really well protected.

Bonding and grounding

Bonding is a matter of taking all of the electrical, electronic and metallic masses at a site and connecting them with conductors so they are at the same electrical potential.

The primary reason is personal safety. If someone touches two pieces of equipment, he will not receive a shock. For example, modern house wiring in a kitchen bonds the stove and

Kaiser is president of Lightning Master, Clearwater, FL.

AutoCELL™

A New Dawn for Autotune Cellular Tx Combiners!



Automatic Frequency Re-Allocation Now a Reality!

Imagine an autotune Tx combiner with the best ceramic resonators from Antenna Specialists and the patented technology from Decibel's Sentry 8000™ Remote Site Monitors. That's new AutoCELL 7000.

The features and benefits are truly awesome!

- ☐ AutoCELL continually makes adjustments and periodically retunes to frequency, compensating for any drift.
- ☐ Ceramic resonators and autotuning permit small, space-saving size and frequency separation as close as 210 KHz with a minimum insertion loss as low as 1.5 dB.
- ☐ AutoCELL provides faster tuning to any given resolution.
- ☐ In frequency re-allocation between overloaded and under-used sites, the AutoCELL channel tunes automatically to any applied signal within its frequency and dynamic range. No external information or command is required. It can also be retuned by telephone via RS232 or adjusted manually at any time.

- ☐ Benefits can include clearer signals, fewer busy signals, less interruption of service, more subscribers and less churn. Plus the savings of management and technical resources! Each AutoCELL is designed with microprocessor circuitry, a high Q ceramic dielectric resonator, a dual junction isolator, a tuning error detector and an automatic tuning mechanism. Alarms are also included.

Model ATG7020 is now available in a 4-channel configuration that can be phased with additional 4-channel units for up to 24 channels.

With a frequency range of 820-960 MHz, AutoCELL combiners are now applicable to AMPS, NAMPS, TACS and ETACS.

For more information contact the Marketing Departments at either Decibel Products, P.O. Box 569610, Dallas TX 75356-9610 or Antenna Specialists Co., 30500 Bruce Industrial Parkway, Cleveland OH 44139-3996.

For Decibel phone 1-800-676-5342 or FAX 1-800-229-4706; for Antenna Specialists phone 1-216-349-8400 or FAX 1-216-349-8407.

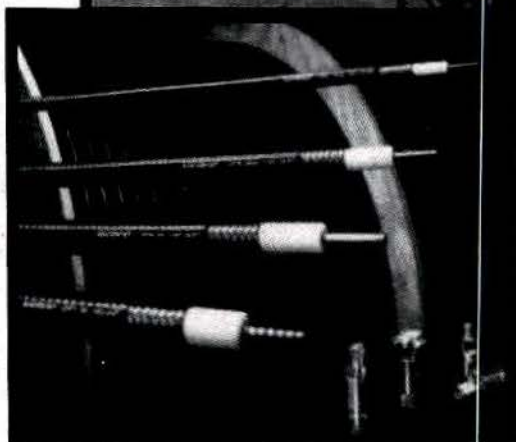
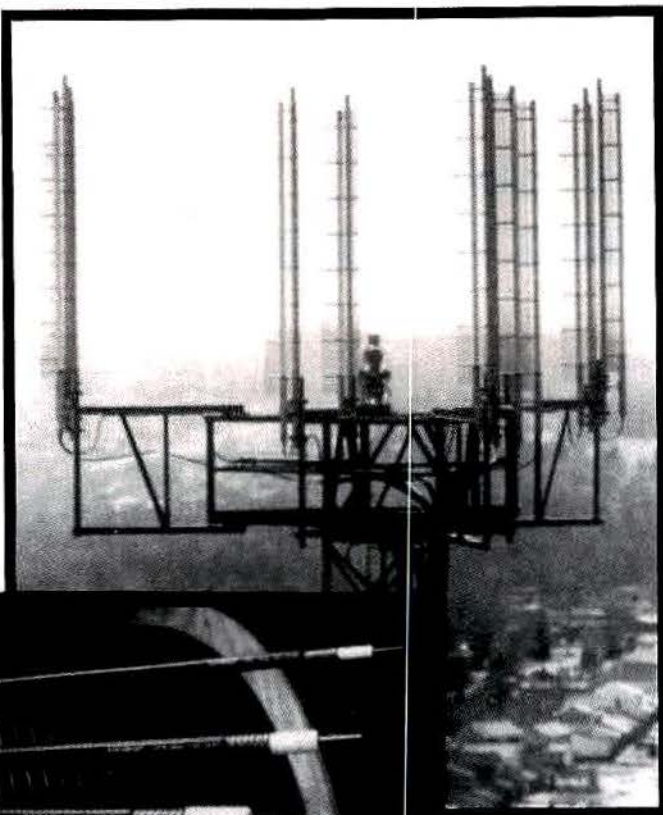


Members of the ALLEN TELECOM GROUP



ANDREW

Cablewave Systems

CELWAVE**cushcraft/Signals****PolyPhaser**
CORPORATION**MICROFLECT**

It's Spring Antenna Planting Season!

Time to order fine quality products from Andrew, The Antenna Specialists, Cablewave, Celwave, Cushcraft, Decibel, Maxrad, Microflect and Polyphaser.

We'll supply all your Base Station and Control Antennas, Cable, Connectors, and Installation Accessories.

All you have to do is call! **It's that easy!**

The Complete Mobile Communications Distributor.

CA Communications Associates Inc.

305 N. Republic Avenue P.O. Box 2399 Joliet, IL 60434
U.S. (800) 435-9313 Illinois (800) 892-1611
Order Fax (800) 284-4934

Circle (26) on Fast Fact Card

refrigerator together so someone touching them both at the same time does not receive an electrical shock.

Bonding not only protects people, it protects equipment by eliminating stray current flow in power and data lines.

Once the masses are bonded, their common electrical potential must be matched to that of the ground. Once again, the primary reason is personal safety.

For example, grounding prevents someone who walks up to the equipment building and grasps the doorknob on the metal door from receiving a shock. The secondary reason is to protect the equipment from stray current flow.

► **Grounding design**—The grounding system design is a function of soil conditions.

The tower should be grounded with a low-impedance system designed to carry electrical current from a light-

The grounding system design is a function of soil conditions.

ning strike away from the structure harmlessly.

The shelter should be grounded and surrounded by a buried counterpoise to protect workers and visitors from step potential across the site.

Step potential refers to a voltage gradient across a distance as the ground charge equalizes toward the lightning strike.

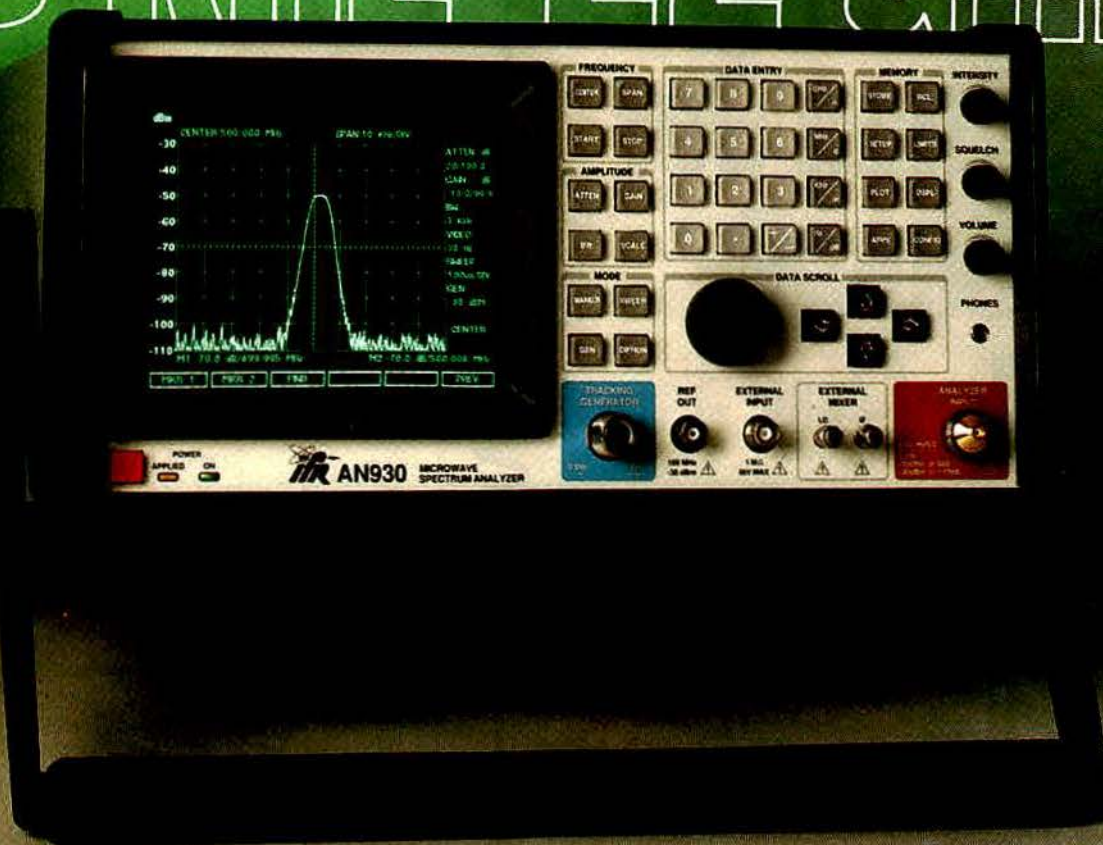
Electrical and wired communications services to the site should be provided a low-resistance ground, and all of these grounding subsystems should be tied together.

► **Bonding design**—The shelter bonding system should be designed so all equipment at the site connects with the grounding system at one and only one point.

Ac power, telephone, data and trans-

Performance and value beyond anything in its class...

9 kHz-22 GHz



AN930 MICROWAVE SPECTRUM ANALYZER

At last, a high performance microwave spectrum analyzer that's truly portable and affordable.

Featuring low-order, preselected mixing and a highly stable synthesized RF system, the AN930 provides superior amplitude and frequency measurement performance over its entire 9 kHz to 22 GHz frequency range. Support for external mixers extends the AN930 measurement range beyond 22 GHz. A high impedance input permits measurement of baseband signals to 0 Hz and 40 volts peak amplitude.

Logical front panel controls on the AN930 reduce most measurements to a few simple steps. A powerful micro-processor provides advanced tools to simplify the solution of many complex measurements. The large, easy-to-read, 7-inch display speeds viewing and interpretation of measurements.



STANDARD FEATURES INCLUDE:

+30 dBm to -120 dBm measurement range, 300 Hz to 30 MHz analog resolution bandwidth, 3 Hz to 100 Hz digital resolution bandwidth, built-in 1 Hz resolution frequency counter, high speed time-domain sweep with pretrigger and delayed trigger, sensitive AM/FM receiver, RS-232 and IEEE-488 interfaces, and operation from DC power.

OPTIONAL FEATURES INCLUDE:

Rechargeable battery pack, built-in 2.9 GHz tracking generator, internal memory expansion (up to 99 traces and control setups plus 64 kbyte user-definable macro storage memory), 200 Hz to 1 MHz supplemental resolution bandwidth filters including EMI bandwidth filters, quasi-peak detector, and 0.02 ppm high stability time base.

For more information or a demonstration, contact your local IFR distributor or representative, or call IFR directly at 316/522-4981.

IFR SYSTEMS, INC.

10200 West York Street / Wichita, Kansas 67215-8935 U.S.A.
Phone 316/522-4981 / TWX 910-741-6952 / FAX 316/524-2623

MADE WITH PRIDE IN
USA

The Only Thing Stronger Than Our Signal Is Our Whip.

1st WORLD'S BEST ON-GLASS ANTENNAS

When performance and durability are critical, Larsen's new KG 825 delivers both.

Our patented exterior radiating circuitry, precision factory tuning, low VSWR and copper plated rods produce the strongest signal on the market.

And you can actually bend our 17-7 steel whips in half and they spring back without damage—including our unique, new flexible enclosed coils. (We don't recommend you try this with our competition.)

Your customers expect signal strength and long-lasting durability plus outstanding customer service. And that's exactly what you can expect from Larsen.

For information on the industry's best cellular antennas, call 800-426-1656.



mission lines should be routed to the shelter so they can be bonded to a unified lead to ground. All equipment within the shelter should be bonded to a master bus bar, which then is bonded to the services ground.

Using this method ensures that there is no difference in electrical potential across equipment to cause damage and that the electrical potential of all site equipment rises and falls together when a surge current flows.

Surge suppression

All conductors leading into a site from the outside are a potential source of mischief.

Indeed, most of the damage commonly referred to as lightning damage actually is caused not by direct lightning strikes, but by electrical current surges entering the site on the various utility service lines. Surge suppression devices limit these electrical transients.

Several factors affect surge suppression.

One important consideration is the difference between lightning arrestor technology and transient voltage surge suppression technology.

Lightning arrestors provide protection by dumping the surge from the phase wire to the ground wire. The transient voltage travels on the ground wire back to the service entrance where the ground and neutral wires are bonded.

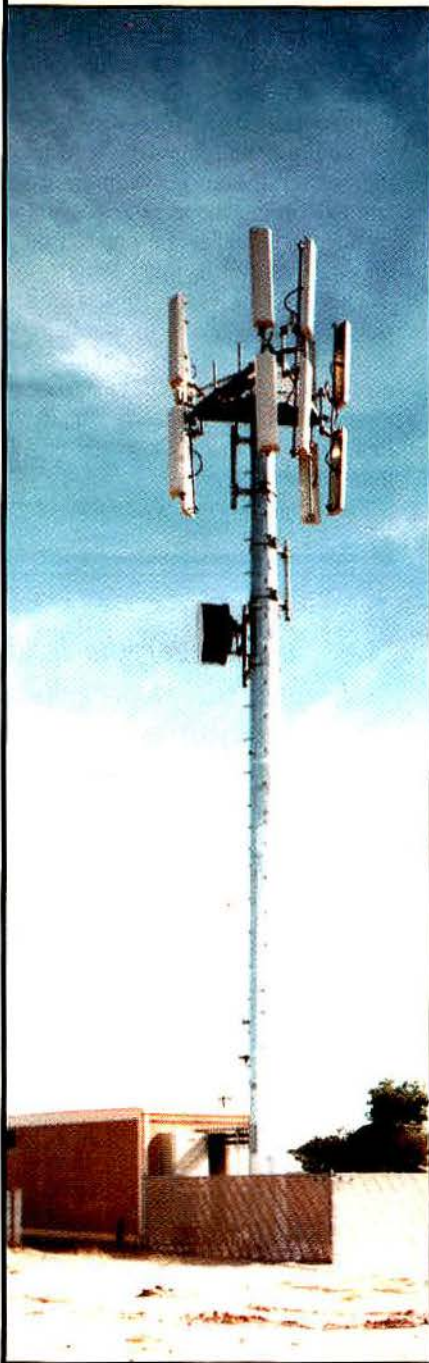
Then, traveling on the neutral wire, the voltage reflects back to the equipment the lightning arrestor is supposed to protect, causing a difference in potential between the phase and neutral wires.

Transient voltage surge suppression (TVSS) technology, on the other hand, provides protection from phase wire to ground wire to neutral wire to phase wire, limiting the difference in electrical potential among all wires in the system. This concept works with all types of power, telephone company and data lines.

High-capacity surge suppression devices sometimes are packaged in large cabinets. Therefore, they must be placed several feet from the device they are intended to protect.

They are connected to the device

LEAST-COST ROUTING

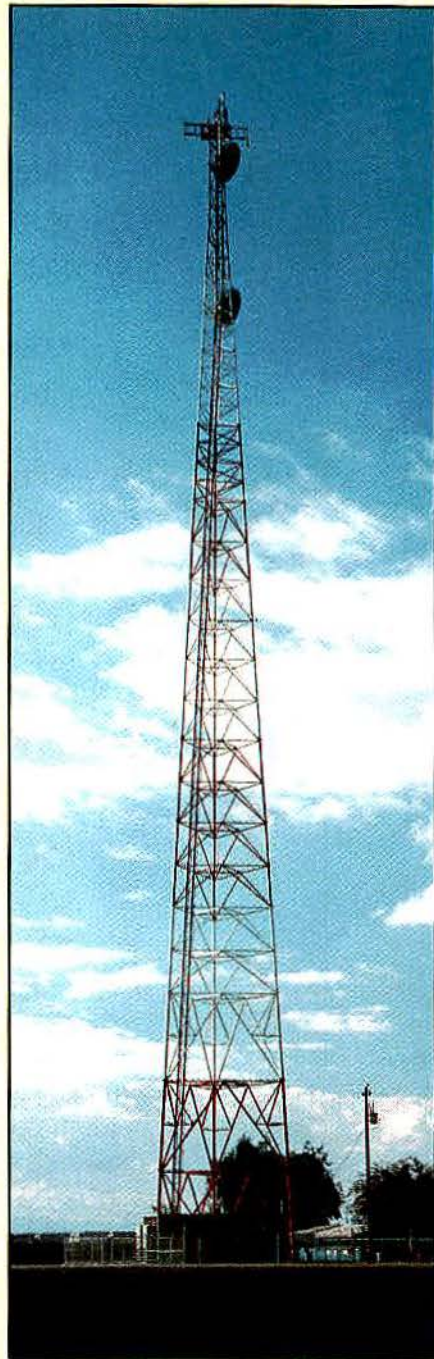


When you choose PathCom you choose lower tower cost without compromising quality.

And you will find that PathCom's towers excel in:

- Suitability
- Quality
- Ease of Installation
- Prompt Delivery
- Durability

With three decades of focus on tower design and construction, and over 5,000 worldwide tower installations, PathCom should be your future supplier.



COMPLETE PRODUCT LINES:

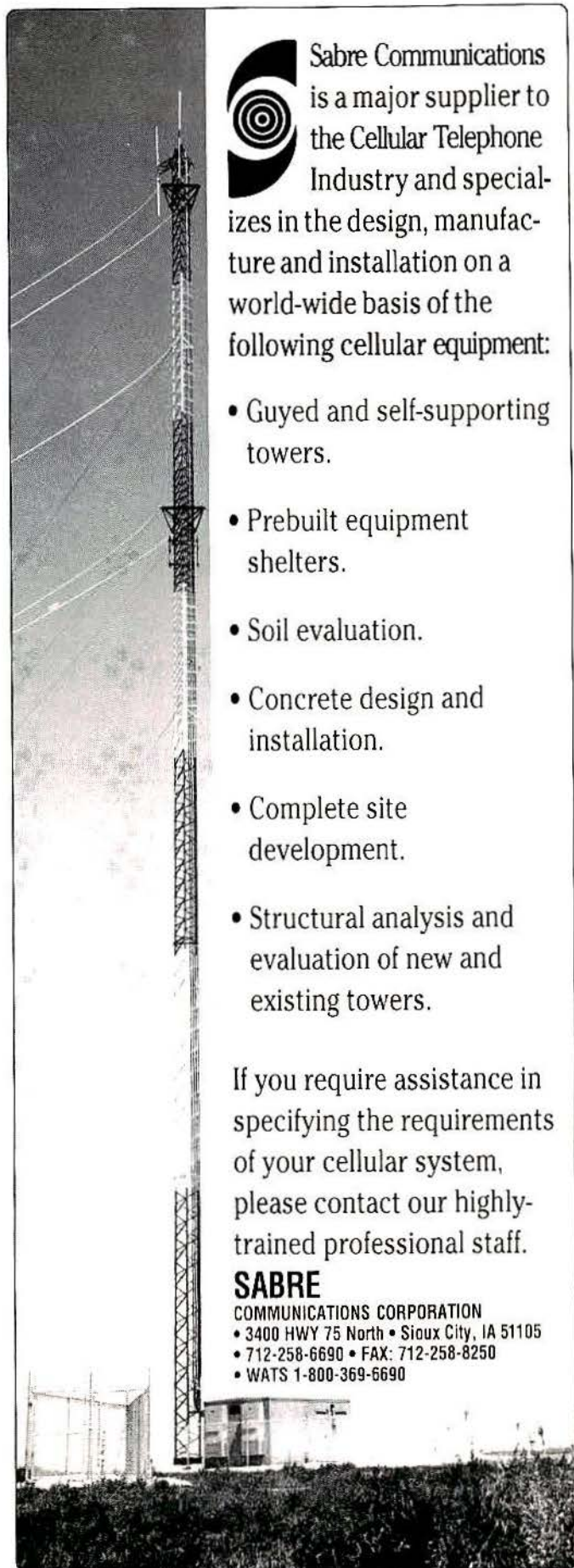
- Self Supporting
- Pipe Leg
- Guyed
- Solid Rod
- All Angle
- Turn Key Services
- All Welded

For more information on PathCom's complete product line:



**PathCom
Corporation**

Phone 800-223-4771
903-586-9812
Fax 903-586-1590



 Sabre Communications is a major supplier to the Cellular Telephone Industry and specializes in the design, manufacture and installation on a world-wide basis of the following cellular equipment:

- Guyed and self-supporting towers.
- Prebuilt equipment shelters.
- Soil evaluation.
- Concrete design and installation.
- Complete site development.
- Structural analysis and evaluation of new and existing towers.

If you require assistance in specifying the requirements of your cellular system, please contact our highly-trained professional staff.

SABRE

COMMUNICATIONS CORPORATION
• 3400 HWY 75 North • Sioux City, IA 51105
• 712-258-6690 • FAX: 712-258-8250
• WATS 1-800-369-6690

Circle (30) on Fast Fact Card

with lead wires, the length of which can have a critical effect on the surge suppressor's performance.

For example, a 5-foot lead length can increase a 500V clamping value to 1,800V because of the wiring inductance. Plus, the longer the lead length, the slower the surge suppressor's response time. These changes are not caused by a surge suppressor defect; they are caused by lead length.

The answer is to look for high-power-density devices packaged in reasonably sized boxes that can be nipped directly to the device to be protected. In this way, leads can be limited to an ideal length, preferably less than 12 inches.

Staged protection is a surge suppress-

... the longer the lead length, the slower the surge suppressor's response time.

sion system design that many prefer.

Instead of relying on one big high-rating device at the service entrance, staged protection uses additional devices downstream at distribution boxes and near the protected loads. This approach solves the problems of let-through voltages and of surges induced electromagnetically into the house wiring inside of the primary surge suppressor.

Electric utility studies have shown that the vast majority of power transients seen by equipment do not come from the outside. Instead, they are generated within a facility.

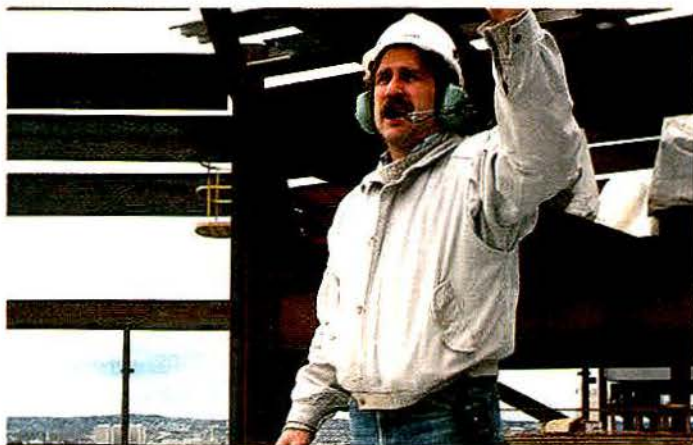
Whereas a large device at the service entrance cannot help with this problem, secondary devices on distribution panels can suppress a transient from one circuit, such as the air conditioning compressor, before it is redistributed onto other circuits, such as the radio circuits.

Be sure the suppression products have been tested and rated as complete units. If a device is tested at the raw,

APPLICATIONS FOR NOISE-ATTENUATING HEADSETS



David Clark Company's VOX (voice-activated) System allows crane operators to keep both hands free to work the controls. They hear instructions the first time, avoiding costly errors.



A foreman's job depends on clear communication. Noise-Attenuating Headsets, with noise-canceling microphones, allows use of the radio, regardless of background noise.



The safety of many people depends on the pump operator's ability to hear and transmit messages clearly. David Clark Headsets make this possible.



The constant noise of the locomotive makes it very difficult to transmit and receive on the radio. Noise-Attenuating Headsets offer the perfect solution, combining hearing protection with clear communication.

**Visit Us
at IMCE,
Booths 754/756.**

For durability and reliability, David Clark Company **Noise-Attenuating Headsets** are the clear choice, regardless of your application. All headsets are tested and certified with a Noise Reduction Rating (NRR-24dB), as mandated by the EPA, and are backed by the best customer-service policy in the industry.

Headsets and adapters are available for all types of two-way radios, including:

- PTT (push-to-talk, with boom microphone)
- VOX (voice-activated, with boom microphone)
- VOX-TM (voice-activated, with throat microphone)

Also available: the Series 3800 Intercom System with mobile radio interface.

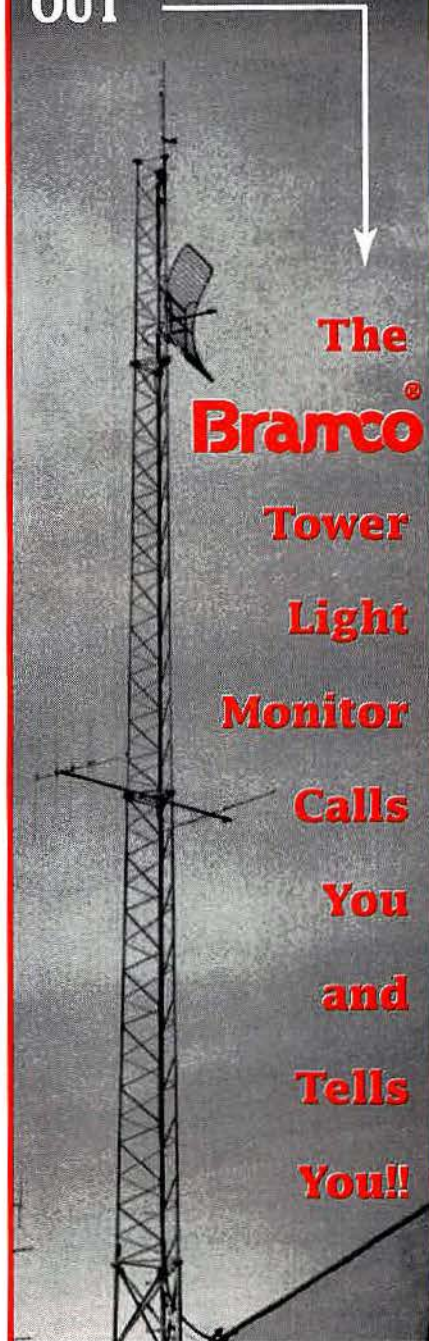
For all these reasons and more, call or write for complete information.



David Clark COMPANY
INCORPORATED

360 Franklin Street, P.O. Box 15054, Worcester, MA 01615-0054
TEL: (508) 756-6216; FAX: (508) 753-5827; TELEX: 920482

CHECKED THE TOWER LIGHTS LATELY? IF ONE BURNS OUT



For Details Call ...

Bramco, Inc.

513-773-6255

or Fax

513-773-8003

Circle (32) on Fast Fact Card

unassembled values of its components, such factors as impedance stemming from circuit geometry are not considered. They can raise clamping values and lower reaction times considerably.

Structural lightning protection

Even with the best bonding and grounding system and with the best surge suppression devices in place, it helps to take steps to reduce the number of times the radio site and tower are struck by lightning.

Systems are available to reduce the accumulation of lightning-caused static ground charge on the facility. They interrupt the process that completes the lightning strike by retarding the formation of lightning-completing streamers in both height and time. At least one such system usually is described as a static ground charge dissipation system.

Several factors about a static dissipation system deserve consideration.

A structure's ground charge accumulation and streamer formation are predictable, according to the rules of point discharge phenomena. Does the system take advantage of the structure's natural charge accumulation and streamer-producing characteristics, therefore enhancing natural dissipation, or does the system require a separate structure to support the dissipator?

Systems requiring a separate structure can be more costly and less efficient. The tower's purpose is to support revenue-producing radio communications antennas, not to support a lightning protection system. Any lightning protection system that imposes excess weight or wind loading on the tower causes unnecessary and counterproductive structural stress.

One of the best ways to evaluate a particular system is to discuss its performance with others who use it on facilities similar to yours. It seems as though everyone likes to talk about

lightning and the methods for preventing lightning damage. Reputable manufacturers of structural lightning protection systems are happy to provide references.

Unified approach

What happens when a site operator installs the world's best bonding and grounding system and the world's best structural lightning protection system—but no surge suppression devices—and the utility pole in front of the site is struck by lightning?

Surge current comes in on the power or telephone lines and lets the smoke out of the electronic equipment inside the building.

Most technical people know that when an electronic device is manufactured, it is filled with smoke. In spite of the information in most sales brochures, the smoke actually makes the device work. When the electronic device fails, all of the smoke gets out, so it stops working. You can prove this

merely by looking at any device destroyed by lightning. All of the smoke has been let out, and the device no longer works.


What if the bonding system is connected to the grounding system at multiple points and lightning

Any lightning protection system that imposes excess weight or wind loading on the tower causes unnecessary and counterproductive structural stress.

strikes the woods near the site?

The step potential across the site lets smoke out of the equipment.

What if the structural lightning protection system is omitted and a direct lightning strike to the tower produces an electromagnetic pulse (EMP) that induces transients within the electronic equipment? Again, the smoke gets out.

Effective lightning protection is a 3-part approach that combines bonding and grounding, voltage surge suppression and structural lightning protection into a unified system designed to keep the manufacturer-installed smoke in all of your equipment. 

Why Midland is making a serious "bid" for your portable radio business.

Midland's Syn-Tech XTR™ wideband VHF and UHF 70-195/295's are ultra-versatile, high spec radios in the top tier of advanced portable technology. They offer a wide selection of capabilities like 99 channels programmable by groups, 40 channel-per-second priority scan, secure scrambling, and virtually any signaling protocol (including digital selective call and status reporting), to name a few.

Midland understands that radios in this class, with such sophisticated operational features, ***simply cannot be judged from written specs alone.*** That's why we're making this special "bid," with a substantial incentive, to put an evaluation sample in your hands – set up the way you want it for field testing in your own system environment.

Take us up on our offer today. You'll be astonished how much performance we designed into so small, light and rugged a package. You'll find the published specs equal to or better than any other comparable units. And, the operational benefits of these remarkable portables will be a revelation.



Ask for your "SEALED BID" from Midland LMR.

Call or fax today for this special offer including detailed bid specs on the Syn-Tech XTR portables and information on obtaining an evaluation unit.

1-800/MIDLAND

Ext. 1690

FAX: 1-(816) 245-1144

MIDLAND LMR
LAND MOBILE RADIO

Inspection programs improve site management results

Radio communications companies that prosper in the future will be those making the best use of their assets. Use an appropriate inspection program to plan acquisitions, preventive maintenance and upgrades.

By Bruce A. Kaiser

What goes up must come down.

When it comes to a radio communications tower, we hope not!

To keep a tower standing and in sound condition requires knowing when it needs maintenance and repair. Unfortunately, many communications sites are "out of sight, out of mind."

It is not unusual for smaller communications companies to pay attention to the site and its tower during construction and thereafter only when there is a problem.

The radio communications industry, including two-way radio, radiopaging and cellular mobile telephone, has been discovered by large companies that bring more sophisticated controls to operations and asset management. All companies, large and small, can apply these practices to communications sites.

Reliability and system performance are key factors in limiting churn, which refers to customers switching among service providers within the same market. Similarly, operators of private systems have a vested interest in sustaining their communications at all times.

Scheduled preventive maintenance

Kaiser is president of Comprehensive Tower Inspection, Clearwater, FL.



Inspectors Jay Cribbs (left) and David Bolton time the strobe lights on a cell-site tower near Paola, KS, to verify proper operation.

keeps sites in peak operating condition. Asset control requires an inventory of site equipment. These two programs are based on information about the

equipment's present condition and performance trends.

Site inspection acquires the necessary information for intelligent operating and maintenance decisions. There are five types of inspections:

► **Post construction**—Immediately after site construction is complete and before the contractor's final draw payment is released, the post construction inspection is performed.

Information gathered in this inspection allows the owner to determine whether everything that was ordered was delivered, was installed properly and is working.

This information includes the make, model and serial number of all site components. Testing includes confirmation of installation to the owner's specification and to industry accepted standards, and performance to manufacturer and system design specifications.

This inspection's primary objective is to identify discrepancies so they can be corrected before the contractor receives final payment. This procedure gives the contractor an incentive to correct discrepancies in a timely manner.

► **Periodic**—Once a site is operational, it is important to note the site components' condition and operation regularly.

The periodic inspection of the site reveals operational problems so they can be repaired. Information gathered during several such inspections reveals trends that may be reversed to

The New STABILOCK® 4015 Radio Test Set Tests Great—Less Weight

Under
\$13K/3 Year
Warranty

Finally, a two-way radio tester that fits under a helicopter seat, weighs less than 20 lbs., provides all the capabilities you've dreamed of in one unit, and doesn't cost an arm and a leg.

The STABILOCK 4015 packs a lot of features in a compact design:

- ☐ spectrum analyzer with audio
- ☐ electroluminescent display for easy viewing night or day
- ☐ licensed CLEAR CHANNEL LTR® testing capability
- ☐ memory cards to load and run tests automatically, including all cellular formats
- ☐ digital storage oscilloscope
- ☐ internal battery

Lighten your two-way test load today—call for more information on the STABILOCK 4015:

1-800-225-5765 (in MA: 508-671-9700).

CLEAR CHANNEL LTR is a registered trademark of the EF Johnson Company. STABILOCK 4015 is a registered trademark of Schlumberger Technologies.

NEW OPTION



EDACS™
Trunking Licensee

Processor: GE Mobile Communications Inc.
Mountain View Road • Lynchburg, Virginia 24502

Quality Test Solutions Schlumberger Technologies

Schlumberger Instruments
P.O. Box 7004
829 Middlesex Turnpike
Billerica, MA 01821, USA
Phone-508-671-9700
Fax-508-671-9704
1-800-225-5765 (outside MA)



Schlumberger Technologies

Canadian Representative
Atelco Limited
9225 Leslie St. Unit 7
Richmond Hill, Ontario
L4B 3H6
Phone: 416-882-9455
Fax: 416-882-9454

Schlumberger Instruments
Victoria Road
Farnborough, Hampshire
GU14 7PW, England
Phone-44 252 544433
Fax-44 252 549854
Telex-858245

Schlumberger Instruments
50 Avenue Jean Jaurès
BP 620-06
F-92542 Montrouge Cedex, France
Phone-33 1 47 466700
Fax-33 1 47 466727
Telex-631468 ENERINS

Schlumberger Technologies GmbH
Ingolstädter Str. 67a
D-8000 München 46
West Germany
Phone-49 89 31889-0
Fax-49 89 31889-160
Telex-5215015 SMG D

Circle (34) on Fast Fact Card

prevent small problems from becoming big ones.

The periodic inspection's objective is to ensure that the site remains in acceptable condition.

Aggressive, responsible operators tend to see the need for periodic inspections out of self-interest, that is, to keep their systems up and running at peak performance.

Less responsible operators may not see a pressing need. Nevertheless, periodic inspection eventually may be forced upon them by the insurance industry in a way that is not in their best interest. It may become difficult or expensive to obtain insurance without a periodic site inspection program.

► **Pre-purchase**—Many radio communications businesses are growing by acquiring existing sites or systems.

Before acquiring a site, it is a good idea to know what equipment and facilities are at the site, their condition and operating performance. Believe it or not, sellers sometimes exaggerate their properties' condition.



Bolton photographs a tower side light for the inspection report and permanent record.

A site inspection can be a useful element in price negotiations. It can discover whether the site is acceptable and compatible with the rest of the buyer's system.

The primary objective of the pre-purchase inspection is to ensure that the buyer knows what he is getting.

► **Post-acquisition**—In the event a number of sites are acquired without a pre-purchase inspection, a post-purchase inspection can be used to determine what was purchased.

Writing an inventory of site components is a large part of this inspection. Assessing the condition and performance of site equipment allows the operator to make immediate repairs and modifications. A program of preventive maintenance can be based on this assessment.

The primary objective of the post-acquisition inspection is to ensure that the buyer knows what he bought and to make plans for upgrading the site as necessary to meet the buyer's requirements.

Follow the Leader



The Model 640 DAPT XTRA -- the Leader in Value, Quality, and Support.

The Model 640 DAPT XTRA paging terminal entered the field in 1991 with an impressive list of standard features and an amazingly low price. It quickly took the lead as the best value in its class. The DAPT XTRA's track record for reliability and support has helped it maintain that lead. Zetron's commitment to ongoing feature development and upgradability ensures that the DAPT XTRA will stay out in front for the long run.

Standard Features:

- 1,500 Pager Capacity
- 2 Telco/RS-232 Ports, expandable to 4
- 280 Seconds of Voice Storage
- System Voice Prompts
- Alphanumeric Paging
- 16 Transmitter Zones w/Sequencing
- Remote Tone Control
- Repeat Paging
- Group Paging
- Individual Call Counts
- System Alarm Output
- 24-Hour Remote Factory Support

Options: Dual TNPP Network Interface • Dual Telco/RS-232 Card • Dial Click Decoder • MF Decoder • Floppy Disk Backup

DAPT XTRA Puts You In The Winner's Circle !



12335 134th Ct. N.E.
Redmond WA 98052
Phone: (206) 820-6363
Fax: (206) 820-7031

Come see us at
I.M.C.E. - Spring
Booths 1463 and 1465

**Whether you're looking for a paging terminal,
or you already have one...**



The DS5000 will give you the competitive edge.

*No other terminal can match the capabilities
of the new DS5000:*

- ▶ Paging: 2-tone, 5-tone, GOLAY, POCSAG 512, POCSAG 1200
- ▶ Alphanumeric transcription from voice mail: activated/de-activated by subscriber
- ▶ Live operator telemessaging: activated/de-activated by subscriber
- ▶ DirectLink (meet me): allows subscriber to be connected to a caller; activated/de-activated by subscriber
- ▶ Discreet DirectLink: allows DirectLink access by pre-selected callers
- ▶ Integrated voice mail:
 - unlimited system and custom prompts
 - unlimited time recording
 - unlimited message retention
 - auto retrieval: message retrieval from rotary or pulse telephone
 - group message broadcast
- ▶ TNPP networking: direct or dial-up
- ▶ TAP message delivery: dial-up or direct connection to a remote paging terminal
- ▶ Numeric retrieval: allows playback of numeric messages
- ▶ Operator-assisted automatic paging for areas where DID and DTMF are not available
- ▶ Programmable templates allow you to create custom services for any group of subscribers
- ▶ Universal DID and end-to-end (ETE) trunks for voice, numeric, TAP and fax
- ▶ Universal encoders for analog and digital formats
- ▶ Modular hardware and software allow you to expand and upgrade by adding, not replacing
- ▶ Powerful 68040 CPU
- ▶ Fax storage and retrieval: interactive with voice mail (mid '93)

Whether you're buying a terminal, or adding services to your existing system, don't make a move until you talk to us about the DS5000. Call now:

Ralco Electronics Inc.

(soon to be TeleLink Technologies Inc.)

USA and Canada Sales: 1-800-567-8884 Service: 1-800-567-5055
250 H Street, P.O. Box 8110, Blaine, Washington 98230-2107
2696 Nookta Street, Vancouver, British Columbia, Canada, V5M 3M5
Tel: (604) 254-7880 Fax: (604) 254-1853

Circle (36) on Fast Fact Card

► *Specific problem resolution*—As its name implies, the specific problem resolution inspection is designed to isolate the cause of a specific problem and to devise a solution.

The inspection normally stems from a specific complaint or suspicion. If there is an unexplained or unexpected change in the site or its performance, a timely inspection using appropriate test equipment can provide the necessary information to resolve the problem.

The primary objective of the specific problem resolution inspection is to give the owner information to use in fixing a specific problem.

A clear, concise, detailed presentation of the site inventory, condition and performance as researched by an objective third party is the desired result

of a site inspection.

Four types of companies offer site inspections: tower companies, component manufacturers, project management companies and independent inspection companies.

All inspection companies are influenced by their background.

Will a company accustomed to building sites as the lowest bidder have the expertise to conduct the necessary testing and to provide a report at the expected level of sophistication?

Will a component manufacturer have the objectivity to find and report

designed or built?

Some tower companies perform inexpensive inspections in hopes of generating future work by finding discrepancies on the site or tower. A useful policy to protect against potential abuse is not to have any repair work done by the company that finds the problem, or not to have any work done at the time of the inspection—and make the policy known before the inspection.

Another potential problem arises when the post-construction inspection and report are done by the same com-

possible shortcomings in products it may have manufactured?

Will a project management company have the objectivity to find and report possible shortcomings in systems it may have

Inspection objectives

- **Post construction**—To identify discrepancies so they can be corrected before the contractor receives final payment.
- **Periodic inspection**—To ensure that the site remains in acceptable condition.
- **Pre-purchase**—To ensure that the buyer knows what he is getting.
- **Post acquisition**—To ensure that the buyer knows what he bought and to make plans for upgrading the site as necessary to meet the buyer's requirements.
- **Specific problem resolution**—To give the owner information to use in fixing a specific problem.

Keep In Touch with ACCESS™

Color Touchscreen Consoles from Avtec



ACCESS™ - Advanced Concept Communications Exchange & Signaling System for Utilities, Airlines, Gas & Oil Companies and Public Safety - A fully integrated, non-blocking, radio/telephone console system using color touchscreen technology. Touch control, pioneered by Avtec for high capacity voice communications systems, is fast becoming the new standard for dispatch consoles.

Avtec is a licensee of the ERICSSON GE MOBILE COMMUNICATIONS EDACS™ trunking system.

Call or write today -

AVTEC, INC.

4335 Augusta Hwy. • Gilbert, SC 29054 USA

(803) 892-2181 • FAX (803) 892-3715

Avtec



A. Model CT300

- Johnson LTR[®] encode and decode
- POCSAG, NEC, GOLAY
- DTMF encode and decode
- GE Mark V
- 5/6 tone Sequential
- DCS, off the air



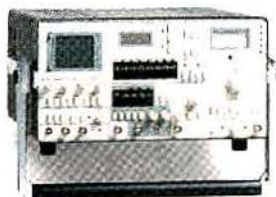
B. Model CT2100

- Rugged and reliable
- Bench quality...field portable
- High resolution dual LCD displays
- Microprocessor driven
- Memory storage
- Battery operated



C. Model CT2500

- Rugged and reliable
- Bench quality...field portable
- Microprocessor controlled
- Memory storage
- Battery operated
- Cellular testing



D. Model CT3000S

- Full featured spectrum analyzer
- Modular construction
- Off-the-air modulation counter
- Analog watt meter
- Oscilloscope
- RF Sweep
- Audio synthesizer
- Audio voltmeter



E. Model CT5100S

- 110 dB dynamic range spectrum analyzer
- True duplex operation
- Tone and digital signaling decode and encode
- Plain English LCD
- Stored settings
- Self diagnostics

We thought you'd prefer multiple choice.

As part of the mobile communications industry, you have testing needs. But your requirements may differ greatly from your competitor. That's why Wavetek offers a variety of communications service monitors.

Our complete line of test equipment ensures you'll have no more or no less testing capabilities than you need. So call Wavetek today at 1-800-245-6356 or (317) 787-5721. Wavetek. Your best choice in communications test equipment.

Circle (38) on Fast Fact Card
Visit us at IMCE, Booth #337.

WAVETEK

pany that handled the construction. Many times, initial transmission line test results are posted at a site for future comparison. These tests were conducted by the transmission line and antenna installer.

Are these tests objective? Was high-quality test equipment used?

When reading the inspection report, keep in mind the inspection company's background. A component manufacturer or installer has a negative incentive to identify problems, and a tower company has a positive incentive. Ideally, an objective third party would identify all problems because it has no stake in future work based on its finding.

No matter what type of company performs the inspection, several basic qualifications and attributes are important.

(1) The company should be experienced in performing inspections on sites similar to yours.

(2) Request references and check them.



Cribbs and Bolton check the large mid-point white strobe and red beacon lights and their mounting hardware.

(3) The workers involved in all inspection and reporting steps should be qualified, experienced and competent.

(4) The company should carry liability, vehicle and workers' compensation insurance appropriate for the type of work done and the state where it is done. If the company is not insured, any liability could revert to the site owner or operator. Request and obtain insurance certificates before work begins.

(5) The inspection crew's equipment, such as transits and test sets, should be high-quality, calibrated equipment. Copies of the calibration certificates should be included in the inspection report. Test sets, particularly those used on transmission lines, should be of scientific quality.

Especially for a new installation, results furnished with the report should be highly accurate to provide a means of gauging system performance and to provide a benchmark for comparing future tests.

The test set operator should be com-

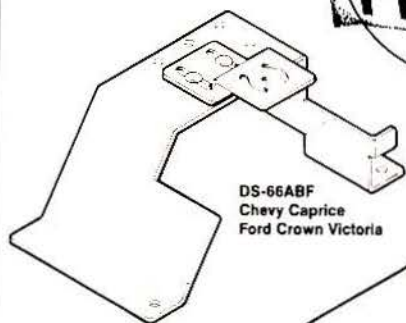
NOW AIR BAG FRIENDLY MOUNTS



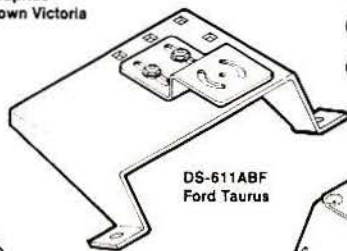
For Your Voice/Data Mobile Communications Equipment

Air Bag Friendly™ mounts secure your equipment outside the air bag deployment zone.

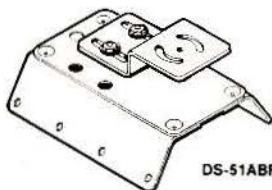
With No Holes Bored™ models, you can mount your equipment without drilling holes in the vehicle floor.



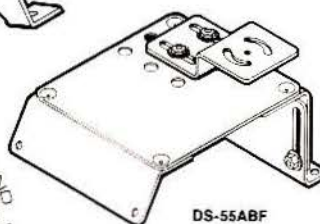
DS-66ABF
Chevy Caprice
Ford Crown Victoria



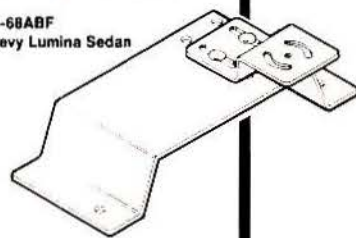
DS-611ABF
Ford Taurus



DS-51ABF



DS-55ABF



DS-68ABF
Chevy Lumina Sedan



For information now

CALL 1-800-GJ-MOUNT (1-800-456-6868)
FAX 1-800-WE-HELPP (1-800-934-3577)



GAMBER-JOHNSON

Service & Solutions™

801 Francis Street, Stevens Point, Wisconsin 54481

Circle (39) on Fast Fact Card

Standard's HX580T:

Two Trunking Formats Plus 800 MHz Conventional!



Three Times The Radio, Three Times The Features, Three Times The Value

Standard's new HX580T offers the best of both trunking systems in a feature-packed portable fully compatible with either EFJ LTR® or Motorola Privacy Plus® trunking formats.

It can even operate as a conventional 109-channel 800 MHz radio, supporting talkaround channels.

All with field programmability, high-speed priority scanning, graphic battery level display, two watt output, programmable DTMF, DCS, ANI & CTCSS, internal self test, and a Mil Spec rating.

The industry's best trunking handheld, delivered with the industry's best warranty: three year's parts and labor.

Count on Standard to deliver.

A Privacy Plus® Trunking Handheld

Fully compatible, with a full complement of convenient features:
Group Select, Subfleet Call, Fleet Call Encode, Fleet Call Decode, Call Alert, 5 Channel Restriction, Multiple Control Channels, Busy Scan Hold, Floating System, Quick Access and more!

An LTR® Trunking Handheld

Packed with features to maximize trunking convenience:
Group Select, Block Decode, Block Decode Timer, Block Transmit Inhibit, Floating System Auto-Transmit, LTR® Talkaround, and more!

A Conventional 800 MHz Handheld

Loaded with unique features:
Group Select, Squelch Tail Elimination, CTCSS/DCS Lockout Talkaround, Monitor/Volume Set, DTMF ANI, Phone Interconnect Encode, Busy Lockout etc.

 **Standard**
Communications

Deliver The Best

SCC Standard Communications, Land Mobile Division, 4876 West North Temple, Salt Lake City, UT 84116 800/767-6695 (FAX 801/359-4122)

LTR is a registered trademark of EFJ. Privacy Plus is a registered trademark of Motorola.

Circle (40) on Fast Fact Card

petent and experienced with the specific make and model of set used. The best test set in the world is only as good as its operator.

This type of test set is not cheap. A scientific-quality set easily can cost \$70,000 with accessories. Request details about the test set and its operator's qualifications.

The inspection crew should have laptop computers and printers on site for accurate and timely report preparation. The crew should use detailed checklists to ensure a thorough job.

Each inspection should be summarized in a written report. Be sure the information is provided in a format useful for you, not necessarily in the inspection company's standard format. The format should be consistent among reports for easy cross-referencing and consistent over time for monitoring trends at each site.

Transmission line results should be available on computer disk (not cards or other unusable media) for trend monitoring.



At the top of the 400-foot tower, the inspectors check the antennas and prepare to install structural lightning protection static dissipators.

All drawings should be computer-generated, not hand-drawn, for easier reading and possible adaptation to future uses. If you have a request for a drawing to fill a specific need, it is much easier and less expensive for the inspection company to change the scale and detail on a computer drawing than it is to re-draw it by hand.

At a minimum, the report should cover the following:

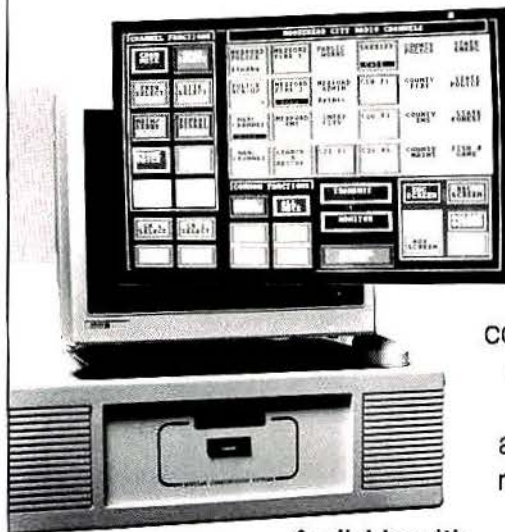
(1) General site information (including directions for driving to the site; latitude and longitude; FAA study number; general site layout, descriptions and conditions; and the testing methods used.)

(2) Information on the tower structure and its condition, including an elevation showing all antennas and appurtenances and tower plumb.

(3) Information on the tower aviation obstruction marking and lighting.

(4) Transmission line information, including transmission line layout at the service entrance and on the tower, and all test results.

The ULTRA-COM PRO lets you design your screens to fit your operating requirements.



Available with
**TOUCHSCREEN
Display**

With the exclusive "Screenmaker" and "Customizer" programs you can design operating screens for function, appearance and color! Now you can adapt your system to your operating requirements

The ULTRA-COM PRO's design is based on the concept of multiple workstations sharing common control electronics. Heart of the system is a 386/486-based PC, supported by Intel's™ 16-bit 8097 microcontroller and its family of support chips to provide the speed and reliability required in today's commercial and emergency communications environments.

Write for detailed literature and specifications.

MODULAR COMMUNICATON SYSTEMS, INC.

13309 Saticoy St., No. Hollywood, CA 91605 / (818) 764-1333 / FAX (818) 764-1992

Circle (41) on Fast Fact Card

POWER ON... with ASTRON.

Astron Corporation is the leading manufacturer of high-quality power supplies and converters for the land mobile industry.

With the new SL-11 series of low profile power supplies, specifically designed for base station applications, the setup is simple, easy and looks attractive. Just mount the radio, with the mounting pads (supplied with the power supply), to the top of the SL-11A ($2\frac{3}{4}$ " H x $7\frac{5}{8}$ " W x $9\frac{3}{4}$ " D) or the SL-11R ($2\frac{3}{4}$ " H x 7 " W x $9\frac{3}{4}$ " D). The power supplies are very well regulated and will provide 11 amps of current at a 50% duty cycle. The units have fold-back current limiting to protect them from overload and short circuit, and an overvoltage protection feature to protect the radio should the output voltage exceed a safe level. All SL series units are available in dark gray or black.

Power supplies and converters from Astron: our unsurpassed quality and reliability have made us the #1 choice in the communications industry.



ASTRON
CORPORATION

9 Autry, Irvine, CA 92718
Telephone: 714/458-7277
Facsimile: 714/458-0826

ASTRON SL-11A

36 D 32A

33

36 D 33A

36 D 35A

FUJI RDP

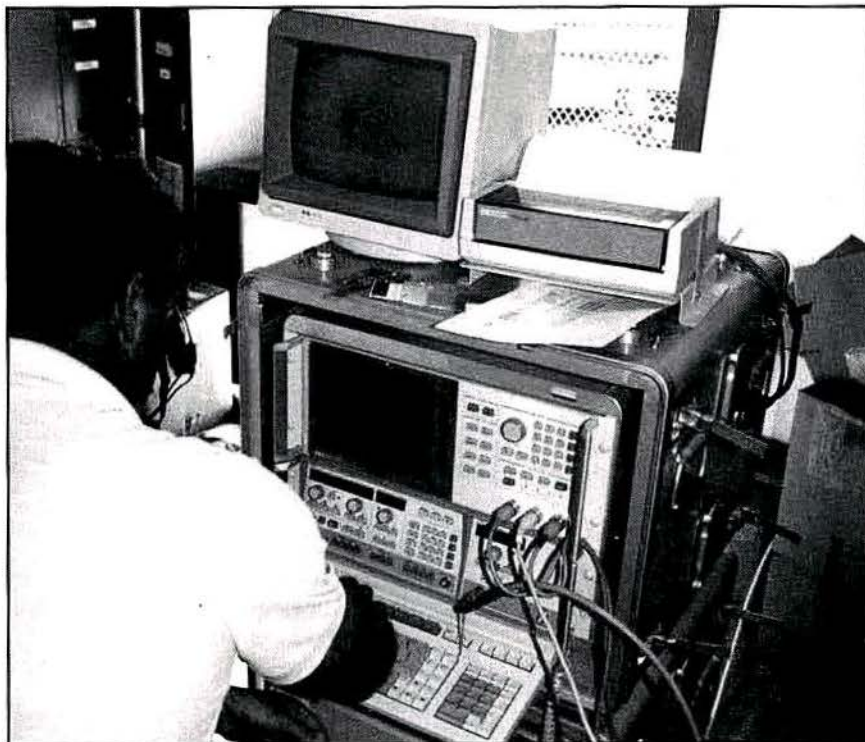
33

FUJI RDP

34

5

FUJI RDP



Inside the equipment shelter, crew chief Dave Swietlicki measures antenna feedline characteristics for the inspection report and permanent record. He also notes any discrepancies between the equipment and grounding system engineering diagram and the actual installation.

(5) Information on antennas and mounts, showing their location, elevation, make, model, serial number and condition.

(6) Site and tower bonding and grounding for personal safety, equipment reliability and lightning protection.

(7) Photographs of all site components and discrepancies.

The report should include a summary of discrepancies, listing work critical to site performance or personal safety and work that is not critical but that should be done.

A complete, well-written and documented report in a useful format is a powerful management tool. This tool, used intelligently, helps to manage field assets, to plan site upgrades to meet system requirements and to plan preventive maintenance.

Radio communications companies that prosper in the future will be those making the best use of their assets.



YOU'LL FIND MORE THAN GREAT NAMES UNDER THIS ROOF

Convenient one-stop purchasing isn't all you get from Hutton. You can receive factory-caliber advice from a team that averages 14 years per person in your industry. You'll seldom experience a backorder because we maintain extremely heavy inventories. And we'll even deliver your rush order overnight when you call by 4 PM. Call toll-free to request a free fact kit.

HUTTON
COMMUNICATIONS

Dallas, Texas
214-239-0580 FAX 239-5264
800-442-3811

Norcross, Georgia
404-729-9413 FAX 729-9567
800-741-3811

Hutton National
Humble, Texas
713-446-4050 FAX 446-5779
800-325-8950

Communications Works
Denver, Colorado
303-820-2929 FAX 820-2809
800-726-6245



HUTTON HAS WHAT IT TAKES

Visit us at IMCE #937 and Entelec #501.

Circle (43) on Fast Fact Card

THREE DIFFERENT MICS. THE SAME EXACTING SHURE STANDARDS.

If you're looking for a high-quality mic with the features you need at a price you can afford, Shure has the answer. Three mics designed to fit the needs and budgets of practically any user and built tough to give you the reliability you've come to expect from Shure.

885TT DTMF – QUALITY THAT'S AFFORDABLE. The 885TT gives you an unbeatable combination of economy, dependability, audio quality, and ease of use. It's a continuous-tone DTMF microphone that sets new standards for value and performance.

Features include:

- Illuminated keypad – designed to last and requiring no extra wiring in most cases.
- Million-Cycle Leaf Switch™ – a Shure exclusive, giving you longer trouble-free use.
- Positive tactile feel keys and audible tone to help make number entry easy and accurate.
- Externally adjustable audio and DTMF levels for easy installation.
- Tailored frequency response and Top-Talk Sound Channels™ provide optimum clarity and intelligibility.

890TT DTMF – THE PROGRAMMABLE CHOICE. The 890TT is a burst-mode DTMF microphone with all the features of the 885TT, plus programmable functions, including:

- Auto-dial feature with ten memory locations (up to 16 digits each).
- Last number redial.
- Lithium battery keeps the programmed memory safe for years.

590T – A DYNAMIC PERFORMER. The 590T, featuring a Shure amplified dynamic cartridge, is ideally suited to a wide range of mobile installations. Tailored frequency response provides optimum voice articulation while it discriminates against other sounds. The 590T is a workhorse designed to provide trouble-free service under the harshest conditions.

ALL FEATURE THE SPEED, VERSATILITY AND COST-SAVINGS OF MODULINK® TECHNOLOGY. All three mics are part of Shure's patented ModuLink System 1. Modular cordsets allow these mics to plug instantly into virtually all of the most widely used radio transceivers with no hardwiring – making installations and cable replacement, literally, a snap. Replaceable cordsets also help reduce inventory and lower repair costs.

THE FINAL WORD ABOUT QUALITY. At Shure commitment to quality is not simply talk. You'll be able to see and feel the quality of our mics as soon as you pick one up. Because we test them tougher, our mics last longer and perform better.

CALL 1-800-257-4873. We'll rush you a free catalog explaining, in detail, all the features and benefits of Shure Communication mics and a complete radio compatibility chart.



SHURE®

COMMUNICATIONS PRODUCTS

Circle (44) on Fast Fact Card

NOW
ModuLink® Microphones
plug instantly into
ERICSSON/GE
MDS
plus nearly every other
popular radio transceiver.

Adjusting deviation for FM microwave transmitters

Three formulas help technicians to deviate FM microwave transmitters using a variety of test equipment. Deviation can be set accurately without using manufacturers' step-by-step procedures.

By Jeff Ashley

Several basic formulas help technicians to set the frequency deviation for analog broadband FM microwave transmitters. This adjustment process is known as *deviating* or *Besseling* the transmitter.

Rather than being restricted by the manufacturer's step-by-step procedures, the technician can use the formulas to apply the principles behind the manufacturer's procedures. The same formu-

las, which may be used in various situations, allow flexibility with regard to test equipment requirements.

The Bessel functions that describe an FM signal are complex. Nevertheless, using Bessel functions to evaluate the relationship between carrier and sideband energy at different modulation (mod) indexes reveals that as the mod index increases from zero, an FM signal's carrier component periodically disappears.

Often referred to as a *Bessel null* or *carrier drop-out*, this carrier disappearance occurs at specific mod index values called *eigenvalues*, including 2.4, 5.5, 8.6, 11.8 and higher values.

Using eigenvalues makes it easy to define FM transmitter deviation levels accurately. For that reason, the mod index value of 2.4 (2.4048, to be more precise) that produces the first carrier drop-out is used in this article as a formula constant.

Before calculations are made, find out these three facts about the FM transmitter to be deviated:

1. The *test tone level* for the radio's modulator/oscillator (mod/osc) baseband input.
2. The radio's *peak per-channel deviation*.
3. Whether or not *pre-emphasis* is used.

The procedure uses a spectrum analyzer and a tone generator with a 75Ω calibrated output. If the tone generator's output impedance is not 75Ω, bridge a selective level meter across the output to verify proper injection levels to the mod/osc as shown in Figure 1 to the left.

Formula No. 1

The first formula is: Test tone frequency = peak per-channel deviation ÷ modulation index.

The objective is to set transmitter deviation accurately to a chosen per-channel deviation level.

This per-channel deviation value is entered into Formula No. 1 along with the mod index value of 2.4048. Then the test tone frequency may be calculated.

With test equipment set up as shown in Figure 1, when this specific test tone frequency is injected into the mod/osc, the spectrum analyzer displays the first carrier drop-out.

The first carrier drop-out occurs

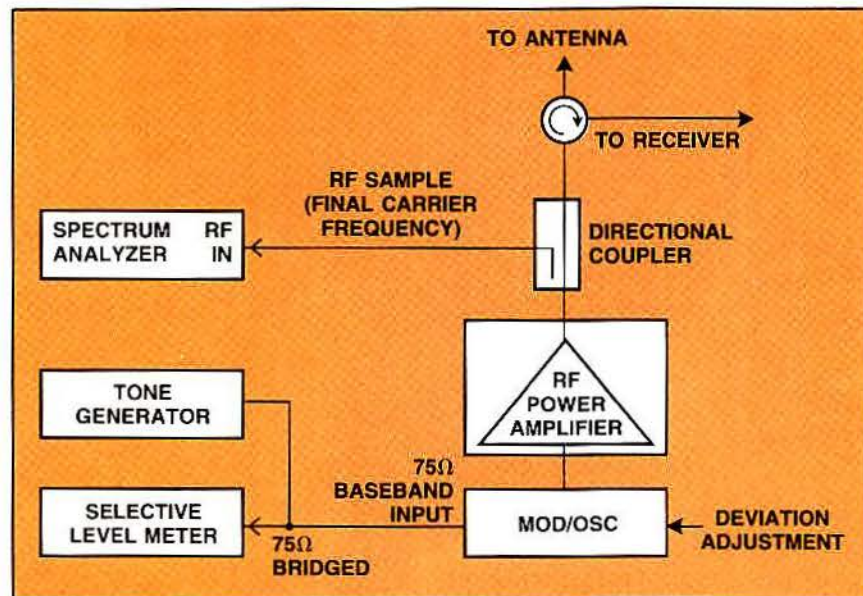


Figure 1. Use this test setup to find the *test tone level* for the radio's modulator/oscillator (mod/osc) baseband input; the radio's *peak per-channel deviation*; and whether or not *pre-emphasis* is used. The procedure uses a spectrum analyzer and a tone generator with a 75Ω calibrated output. If the tone generator's output impedance is not 75Ω, bridge a selective level meter across the output to verify proper injection levels to the mod/oscillator as shown.

Continuing a tradition of excellence.



During the past 40 years, Kyodo products have earned a reputation for quality and reliability. They are used in more than 65 countries around the world. Add to this worldwide reputation our commitment to advancing technology, and you can see why our products represent the highest available value.

Presenting our KG108 series radios. Radios that contain advanced technology without sacrificing our proven quality and reliability. Radios that help you increase customer support, productivity and profits. Radios that offer features you can customize to your specific requirements.

When you purchase a Kyodo radio, you get years of design, manufacturing, and quality control experience. Before the radio leaves the factory, it is subjected to a rigorous quality and performance check to be sure it will perform as we say it will. And all Kyodo radios are backed by the best warranty in the business – to protect you from defects in material or workmanship.

In keeping with Kyodo's tradition of excellence, we believe our KG108 series offers top value in two-way radios.

For more information on our KG108 series – or any of our mobile communications products – why not call us today?

KG108 FEATURES

- All-metal, gasketed, modular construction.
- User friendly, intelligent control system with self diagnostics.
- Wide non-tuning bandwidth.
- PC programming.
- CTCSS and digital CTCSS programmable by channel.
- Choice of major U.S.A. and international frequency bands.
- Programmable transmitter power by channel.
- Choice of nine scanning modes.
- Selective calling with automatic ID, kill mode and transfer function.
- DTMF encoder.
- Transmit time limiter and activity timer.
- Choice of dash, front or trunk mount models.

Circle (45) on Fast Fact Card


kyodo west™

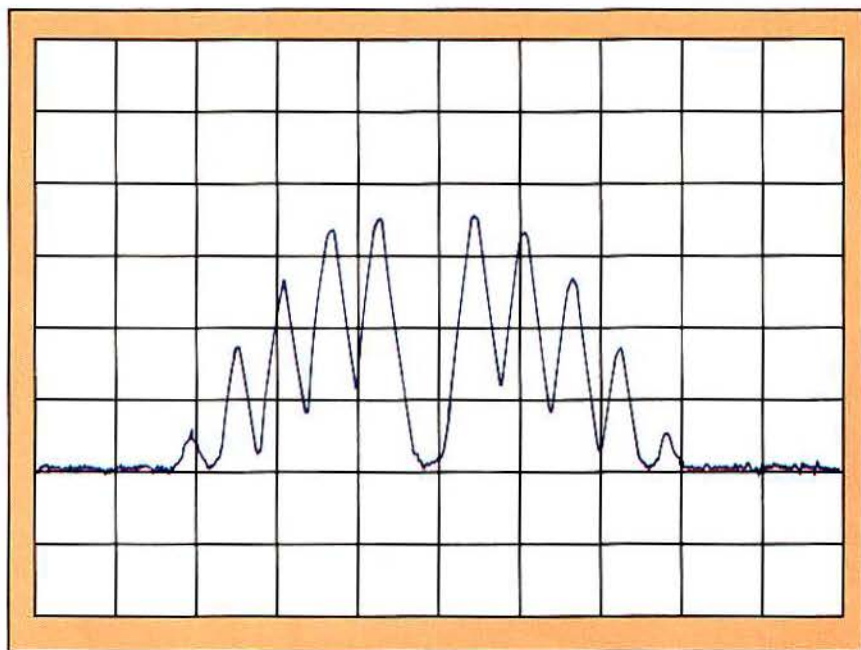


Figure 2. This is what first carrier drop-out looks like on the spectrum analyzer. Note that center carrier frequency energy drops to a null.

when the pre-defined per-channel deviation level is reached as the mod/osc

deviation control is adjusted. The tone level must be set to the *test tone level*

specified for that particular baseband input of the mod/osc.

For example, to deviate a 600-channel microwave radio with no pre-emphasis to 200kHz RMS per channel, first multiply the root mean square (RMS) value by 1.414 (the square root of 2) to find the *peak value* to enter into the formula. Because the mod index at the first carrier drop-out is 2.4048, the test tone frequency is calculated using Formula No. 1 as follows:

Test tone frequency

$$= (200,000\text{Hz} \times 1.414) \div 2.4048$$

$$= 117.6\text{kHz}$$

With the equipment connected as shown in Figure 1, set the tone generator to 117.6kHz at *test tone level*. Beginning from a fully counter-clockwise or minimum position, slowly adjust the mod/osc deviation control clockwise until first carrier drop-out is observed on the spectrum analyzer.

DON'T TRY THIS WITHOUT A PORTAGRIP®.

If you turn an ordinary portable two-way radio holder over and give it a shake, chances are the radio will pop out. But with a PortaGrip from PanaVise, the radio stays firmly in place. This means that when you install a PortaGrip in your vehicle, your hand-held two-way radio will be right where you want it. You won't lose it during a quick stop or a sharp turn!

The PortaGrip attaches to any AMPS-compatible cellular phone mount and has independently adjustable jaws for a custom fit (holds radios 1.6 to 2.6" wide), "sure-grip" soft jaw pads that won't scratch your radio, and easy "one-hand" operation. Plus, it's competitively priced, available with or without a Slimline phone mount, and includes complete installation instructions.

So go ahead — try this test at home. But don't try it without a PortaGrip! For more information, contact PanaVise or your local representative.

PANAVISE®

PANAVISE PRODUCTS, INC.

1485 Southern Way, Sparks, NV 89431

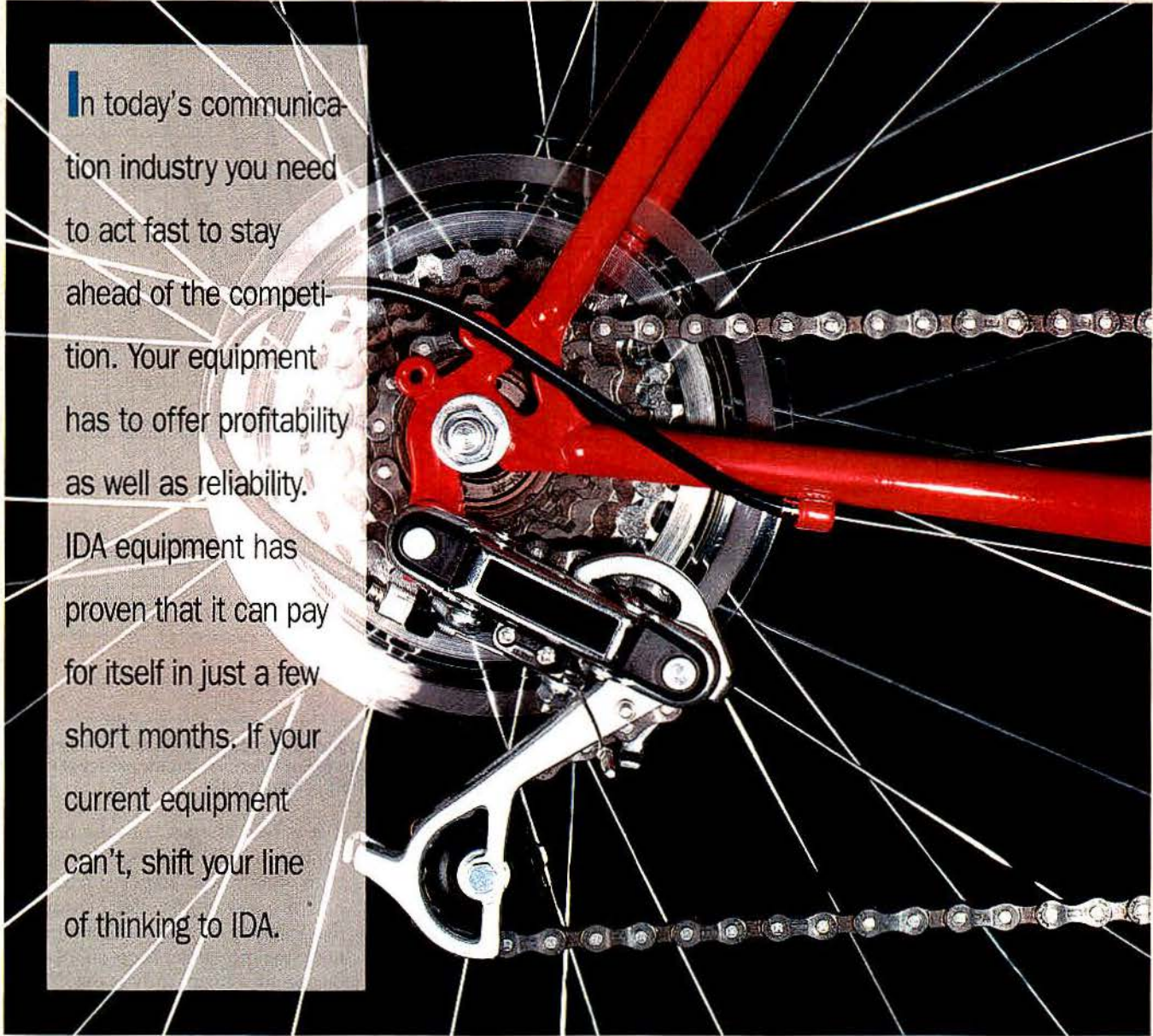
Phone: (702) 353-2900 Fax: (702) 353-2929

Radio not included. PortaGrip (Model #701) sold separately or with a Slimline car phone mount. PortaGrip is made in the USA and is a registered trademark of PanaVise Products, Inc. Patent Pending. ©1992 by PanaVise Products, Inc.



Circle (46) on Fast Fact Card

Shift Your Line of Thinking.



In today's communication industry you need to act fast to stay ahead of the competition. Your equipment has to offer profitability as well as reliability.

IDA equipment has proven that it can pay for itself in just a few short months. If your current equipment can't, shift your line of thinking to IDA.

NET-LINK A proven Multi-site and Multi-user linking system for LTR trunking sites that offers state-of-the-art technology and can pay for itself in a few months.

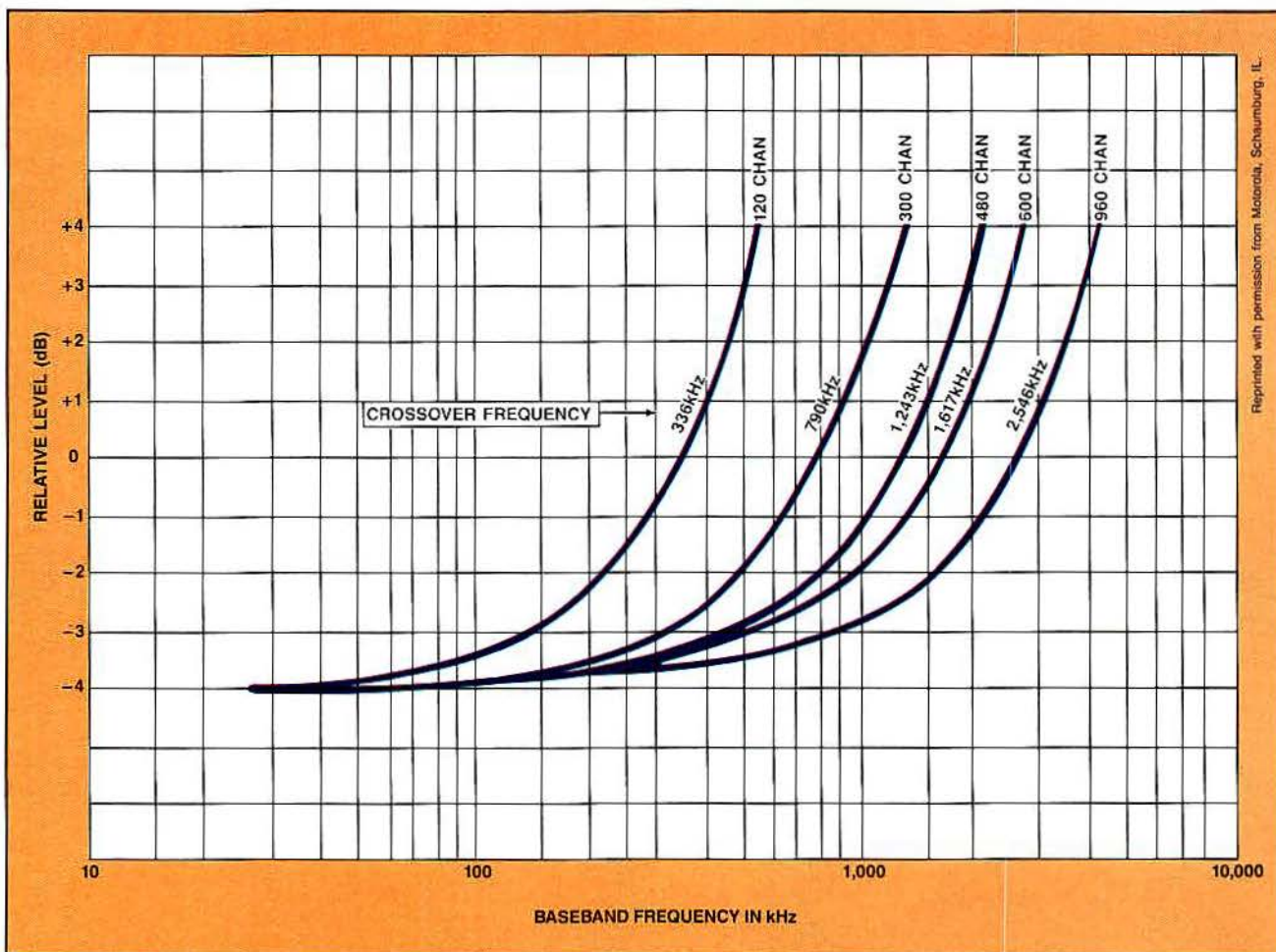
RLC A dependable repeater logic control unit which provides LTR logic at breakthrough low, low prices. Call today for complete pricing.

For More Information Call Toll-Free
800-627-4IDA
(4432)

BETTER IDEAS COME FROM

IDA

IDA CORPORATION 1345 Main Avenue • Fargo, North Dakota 58103
Circle (47) on Fast Fact Card



Reprinted with permission from Motorola, Schaumburg, IL.

Figure 3. If the transmitter uses pre-emphasis, the tone generator output must be changed to compensate for the pre-emphasis curve's roll-off or boost at that particular frequency on that particular channel loading curve. For example, the frequency response characteristics of the 600-channel loading pre-emphasis curve at 117.6kHz have a roll-off of about 4dB.

CABLE SETS

- **HIGH QUALITY**
- **FAST DELIVERY**
- **BEST PRICES**



Call your local distributor

THE ANTENNA FARM
CANCOM COMPONENTS
CMC DISTRIBUTING
COMMUNICATIONS ASSOCIATES
COMMUNICATIONS WORKS
EASTCOM INDUSTRIES

ECONOMY TWO-WAY DIST.
ELECTRO-COMM
GRAHAM RADIO
HENRY RADIO
HUTTON COMMUNICATIONS
JAN INDUSTRIAL

PRIMUS ELECTRONICS
RF SERVICES
SANTA FE DISTRIBUTING
TALLEY ELECTRONICS
TECHNICAL EQUIPMENT DIST.
TESSCO INC.

cushcraft/Signals

48 PERIMETER ROAD • MANCHESTER, NH 03108 USA • TEL: 603-627-7877 • FAX: 603-627-1764 • TELEX: 4948472
800-258-3860 • FAX: 800-258-3868

Circle (48) on Fast Fact Card

It is best to start with the deviation control at minimum because second, third, fourth and higher carrier drop-outs also may be obtained. Starting with the deviation control at minimum helps to ensure the carrier drop-out observed during adjustment truly is the *first* carrier drop-out.

Figure 2 on page 52 shows what first carrier drop-out looks like on the spectrum analyzer. Note that center carrier frequency energy drops to a null.

With this adjustment, the transmitter is deviated properly for 200kHz RMS per channel. The advantage is that the procedure does not require the use of an equipment manual.

If the transmitter uses pre-emphasis, the tone generator output must be changed to compensate for the pre-emphasis curve's roll-off or boost at that particular frequency on that particular channel loading curve.

MICROFLECT'S 700 Series Light-Weight Towers

Microflect's 700 Series towers are available in heights from 10' to 160'. Greater height can be attained when adapted to the top of an 800 Series tower.



Microflect's 700 Series tower line has been designed specifically for light-duty applications, such as cellular, land mobile, UHF/VHF, and 18 & 23 GHz systems. This tower is available in 153 configurations, giving you more application versatility and adaptability than any other structure of its kind.

The features of this tower series include:

- three-leg configuration
- 10' to 160' heights using standard 10' modules
- 12" to 76" wide top
- base widths from 84" to 13"
- a comprehensive line of tower accessories including pipe mounts, grounding, lightning protection kits, and waveguide support components.

This series provides a complete line of light-weight self-supporting towers, backed with the same assurance of quality expected from all of Microflect's products.

For additional information, contact Microflect's marketing department at P.O. Box 12985, Salem, OR 97309-0985, telephone (503) 363-9267, FAX (503) 363-4613. A free copy of the 700 Series Self-Supporting Tower catalog and its price list will be sent upon request.



STREET ADDRESS

3575 25th Street SE
Salem, Oregon 97302

MAILING ADDRESS

P.O. Box 12985
Salem OR 97309-0985

TELECOMMUNICATIONS

(503) 363-9267
TLX 510-599-0107
FAX (503) 363-4613

For example, the frequency response characteristics of the 600-channel loading pre-emphasis curve at 117.6kHz will have a roll-off of about 4dB. (See Figure 3 on page 54.) This means the 117.6kHz tone must be injected into the mod/osc at a level 4dB higher than *test tone level* to compensate.

If the tone generator's maximum output frequency cannot reach the required

117.6kHz, use Formula No. 2.

Formula No. 2.

The second formula is: Change in level (dB) = $20\log_{10}(\text{new tone frequency} \div \text{Formula No. 1 tone frequency})$.

Practically any tone generator frequency can be used, provided the tone injection level is altered by the amount calculated by Formula No. 2. Take care,

however, not to exceed the mod/osc baseband input's maximum input level ratings.

Returning to the original objective of setting the non-pre-emphasized 600-channel radio's per-channel deviation to 200kHz RMS, Formula No. 1 calculates the 117.6kHz test tone frequency, but what if the tone generator can operate no higher than 100kHz? Entering a new test tone frequency of 100kHz into Formula No. 2 gives the following equation:

Change (dB)

$$= 20\log_{10}(100,000\text{Hz} \div 117,600\text{Hz})$$

$$= -1.408\text{dB}$$

This result means that if the tone generator's output is reduced to a level 1.408dB below *test tone level*, a 100kHz tone then can be used, and the results of the deviation adjustment procedure will be identical to results obtained with the 117.6kHz test tone frequency at *test tone level*.

... the spectrum analyzer can be connected to an RF monitor point ahead of a multiplier or multiplier chain ...

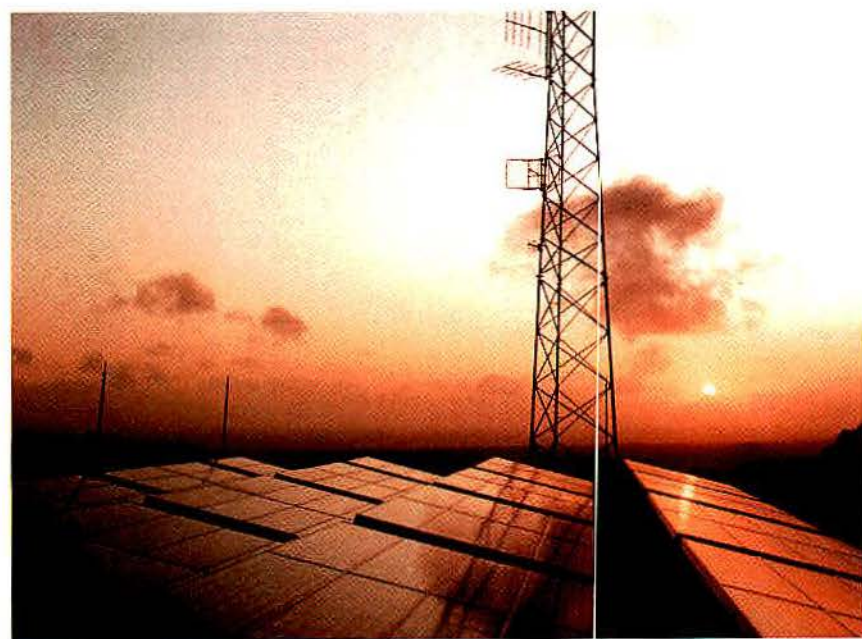
When the radio uses pre-emphasis, compensate for the pre-emphasis curve roll-off using the value indicated at 100kHz.

The curve in Figure 3 shows the compensation is virtually the same as before: 4dB. Therefore, the final 100kHz tone level into the mod/osc is: *Test tone level* - 1.4dB + 4dB = 2.6dB, meaning the 100kHz tone is set to a level 2.6dB higher than *test tone level*.

Often, the spectrum analyzer can be connected to an RF monitor point ahead of a multiplier or multiplier chain to monitor a frequency some fraction of the final carrier frequency. It may be necessary to use such a monitor point

SIEMENS

Siemens and the sun.
Dependable power, anywhere.



In telecommunications systems of every sort, from highway emergency-phones used only intermittently, to radio and television stations broadcasting all day — you'll find Siemens solar modules providing continuous, dependable power.

High-efficiency and field-proven performance have made Siemens M-Series modules the leading choice for solar powered telecommunications installations.

For quality photovoltaic products, backed by a company that can give you the support you need, anywhere in the world, make the intelligent choice. Insist on Siemens.

For complete information contact:

Siemens Solar Industries
P.O. Box 6032
Camarillo, CA 93011
Tel: 1-800/272-6765

Circle (50) on Fast Fact Card

DATA DIVISION

- ➔ FULL RF OPTIONS
- ➔ 4800 BAUD MODEMS
- ➔ LOWEST PRICES



FULL TRANSMIT AND RECEIVE MODULES IN METAL CABINETS

MODEL		25 & UP	USER
TNET MICRO	2 WATTS, THE SMALLEST UHF TRANSCEIVER, (KS-900)	134.90	279.90
TNET MINI	NEW "OMNI-CAN", 2 WATTS, W/CARRIER DETECT	144.90	295.90

TRANSMIT ONLY MODULES IN METAL CABINETS

TNET MICRO	2 WATTS, THE SMALLEST UHF TRANSMITTER	84.90	195.90
TNET MINI	IN NEW "OMNI-CAN", 2 WATT, UHF TRANSMITTER	94.90	199.90

RECEIVE ONLY MODULES IN METAL CABINETS

TNET MICRO	UHF RECEIVE MODULE,	72.90	179.90
TNET MINI	"OMNI-CAN", UHF RECEIVE, W/SIGNAL STRENGTH IND.	82.90	195.90

MODEMS, RADIO MODEMS AND CONTROLLERS

TMODE PRO	HAND PORTABLE 4800 BAUD RADIO MODEM	279.90	499.90
TMODE BASE	DUAL-MODE CONTROLLER BASE, PC CONTROLLED	375.90	599.90
TMODE MINI	4800 BAUD RADIO MODEM IN "OMNI-CAN"	185.90	399.90
TMODE TX	TRANSMIT ONLY, 4800 BAUD IN "OMNI-CAN"	159.90	389.90
TMODE RX	RECEIVE ONLY, 4800 BAUD IN "OMNI-CAN"	155.90	379.90
TMODE M-48	4800 BAUD MODEM ONLY IN "OMNI-CAN"	134.90	259.90
TMODE M-40	4800 BAUD MODEM ONLY, BARE PCB	129.90	249.90

Super data special . . . 2 complete 4800 baud modems with radios . . . plus FREE software! \$399

Yes, this is the best data radio deal you have ever seen! Call for full details.

T-20

The HOTTEST new portable available . . . at a super introductory dealer price!

\$112

Through april 15
quantities limited

- ➔ Full 2 watts output!
- ➔ Very small size!
- ➔ Hi-Viz Yellow available!
- ➔ speaker microphone option!
- ➔ Lexan case
- ➔ 3 year warranty!

800-521-8355

Circle (51) on Fast Fact Card



TEKK

Tekk Incorporated
224 N.W. Platte Valley Dr.
Kansas City, MO 64150
Fax 1-816-746-1093

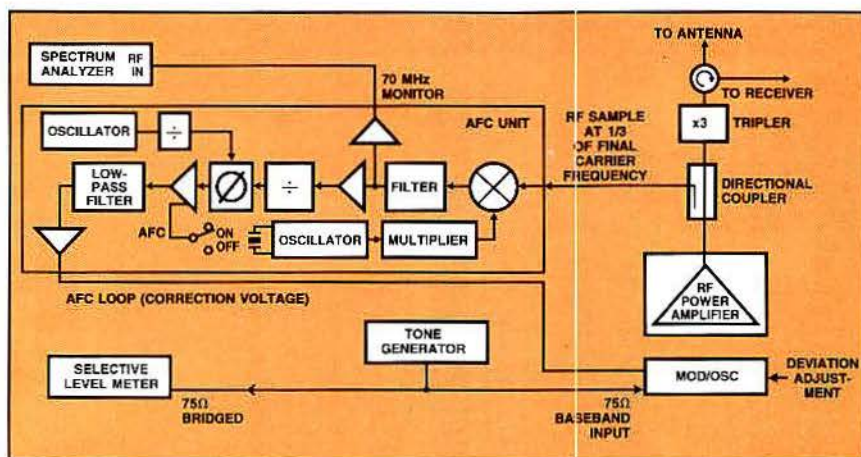


Figure 4. This test equipment setup uses a spectrum analyzer with a maximum frequency that needs to be only 70MHz to monitor RF at one-third of the final carrier frequency.

if the spectrum analyzer's maximum operating frequency is less than the radio's final carrier frequency.

For example, Figure 4 above shows a test equipment setup using a spectrum analyzer whose maximum frequency needs to be only 70MHz to monitor RF

at one-third of the final carrier frequency.

The AFC unit in Figure 4 uses heterodyning to derive the 70MHz monitor frequency. Because the AFC unit uses this method, the per-channel deviation is the same at the mod/osc output and

the 70MHz monitor point.

Nevertheless, the per-channel deviation at the 70MHz monitor point and at the mod/osc output is only one-third of the final carrier frequency deviation because the mod index changes through the multiplier stage.


Using the previous example of a non-pre-emphasized 600-channel radio with 200kHz RMS per-channel and test equipment connected as shown in Figure 4, Formula No. 1 is changed to read:

Test tone frequency

$$= \frac{1}{3} \times (200,000\text{Hz} \times 1.414) = 2.4048$$

$$= 39.2\text{kHz}$$

With a 39.2kHz test tone injected into the mod/osc at test tone level, the deviation control can be adjusted for first carrier drop-out while monitoring the AFC unit's 70MHz monitor point or the mod/osc output at one-third of the final




EAGLE EYE TECHNOLOGIES


THE BENCHMARK OF TOWER MONITORING & CONTROL SYSTEMS!

A DIVISION OF ICT SYSTEMS, INC.


AIRCRAFT SAFETY

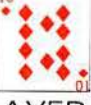


LIGHTING MALFUNCTIONS



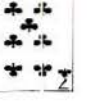
OPERATIONS LOG








PLAYER 1

- TOWER OWNER
- LICENSEES









IS IT WORTH THE GAMBLE ?

RADMOS SERIES

Totally eliminates any possibility of light related fines - GUARANTEED!

As a result of system, or ICT central monitoring station failure.

Tower light monitoring/control

Complete daily trend data

Temperature/Generator

Security/Intrusion

Fire & Smoke

Unauthorized tower climber

UNCONDITIONAL 30-DAY MONEY-BACK REFUND

EAGLE EYE TECHNOLOGIES
A DIVISION OF ICT SYSTEMS, INC.
P.O. BOX 11548 WICHITA, KS 67202

(800) 779-1917
FAX (316) 263-1967

4 New Winners from Midian

\$5995

A
♠

**Model
ANI-U**



**Smallest Multi-Format, Multi Feature
ANI with optional CTCSS encode**

- ♠ ANIs: DTMF, CCIR, ZVEI, DZVEI, DDZVEI, NATEL, EEA, EIA, & MODAT*
- ♠ Optional 51 code CTCSS encoder
- ♠ Delayed CTCSS for inaudible ANI
- ♠ User-programmable tone timings
- ♠ Leading and/or Trailing ANI with mic mute
- ♠ Programmable ANI repeat delay timer
- ♠ Emergency ANI with repeat timer
- ♠ Emergency ANI "man down" delay timer
- ♠ Programmable ANI speed & front porch delay
- ♠ Programmable Busy Lockout
- ♠ Timeout Timer with stuck mic alert tone
- ♠ Available for Midian Zap™ & GE-Star® digital ANI formats (DFA-1/DFA-2)
- ♠ Dimensions: 1.1" x .88" x .22"

A
♦

**Model
RT-8X/TRA**



**RTX-compatible Telephone to Radio
Adapter**

- ♦ Converts standard telephone with RJ11 connector to radiotelephone formats, rural phone, or extended phones when interfaced with simplex or duplex radio
- ♦ Full/Half-duplex or VOX capability
- ♦ Outputs 90 Volts to ring standard telephone bell
- ♦ Built-in dial and busy tones
- ♦ Programmable via telephone Touch Tone® keypad
- ♦ 1-12 digit connect and disconnect ANI
- ♦ 10 number memory dialer with last number redial
- ♦ Also available for DTMF interconnect applications

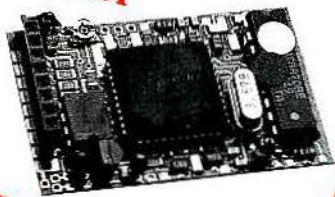
\$25000

**Ready
to
Deal?**

\$11000

A
♥

**Model
RT-8X**

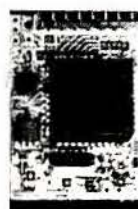


**Programmable DTMF Encoder/Decoder
Compatible with RTX**

- ♥ Three programmable decode numbers for selective calling with multiple ring codes
- ♥ 1-12 digit connect and disconnect ANI
- ♥ Ten number memory dial, last number redial
- ♥ Call routing digit for CES or RTX mobile call
- ♥ Trunking delay for connect ANI
- ♥ Time Out Timer & Busy Channel Lockout
- ♥ Carrier refresh for base or repeater COR/COS
- ♥ CTCSS encoder with programmable modulation
- ♥ Deadbeat Disable for lost or stolen radios
- ♥ Programmable channel scanning
- ♥ Timed automatic disconnect
- ♥ Forced decode reset
- ♥ Dimensions: 1.84" x 1.2" x .25"

A
♣

Model ID-1



Keyboard Programmable Morse Identifier

- ♣ All messages & features programmable via 12-button Touch Tone®-style keypad with alphanumeric characters
- ♣ Sends 16-character station ID or 130-character message at programmable repeat intervals and speed
- ♣ Programmable front porch keypad delay
- ♣ Programmable morse tone freq. (1 to 3000 Hz)
- ♣ Programmable wait time after COR loss
- ♣ Can send morse tone manually
- ♣ Dimensions: 1.4" x 1.1" x .25"

\$7995

To Order Call Toll Free: 1-800-MIDIAN'S

Corporate Headquarters: (602) 884-7981 FAX: (602) 884-0422

MIDIAN

World Leader in Innovative Communications Technology

MIDIAN ELECTRONICS, INC. / 2302 East 22nd Street / Tucson, Arizona 85713

carrier frequency.

The original tone frequency of 117.6kHz also may be used if the injection level is increased by 9.6dB because:

Change in level (dB)

$$= 20\log_{10}(117,600 \div 39,200)$$

$$= 9.5\text{dB}$$

If pre-emphasis is used, the tone level must be adjusted to compensate for the roll-off or boost at the new tone frequency.

Figure 4 shows that the AFC unit's 70MHz monitor point is ahead of the multiplier. Nonetheless, microwave radios often are designed with a 70MHz monitor point after any multiplier stages. With such a design, Formula No.

1 may be used with the full per-channel deviation value.

Many two-way radio communications service monitors have a built-in spectrum analyzer and a tone generator. With this configuration, one piece of equipment, the service monitor, can generate the test tone and view the first carrier drop-out at a 70MHz monitor point.

As a final example, consider how to set a transmitter to a different per-channel deviation. As a sample problem, how would you change a 24-channel, 40kHz RMS transmitter to operate at 48 channels and 26kHz RMS? Formula No. 3 provides the answer. Notice the similarity between Formula No. 3 and Formula No. 2.

Formula No. 3.

The third formula is: Change in level (dB) = $20\log_{10}(\text{new per-channel deviation} \div \text{original per-channel deviation})$.

In this formula, it does not matter whether the per-channel deviation values are RMS or peak, as long as the numerator and denominator both are RMS or peak values.

If the transmitter previously was deviated properly for 40kHz RMS, the only necessary adjustment is to reduce the deviation control setting by 3.7dB to redeviate the transmitter for 26kHz RMS:

Change in level (dB)

$$= 20\log_{10}(26,000\text{Hz} \div 40,000\text{Hz})$$

$$= -3.74\text{dB}$$

These formulas are handy, and they help a technician to deviate any broadband or narrowband analog FM transmitter for any per-channel deviation over a wide range of tone frequencies and levels.

They offer the user more freedom by reducing dependence on equipment manuals. They also offer the user more flexibility by producing the same results with less expensive equipment that may be more readily available.

Reference

Kennedy, George, *Electronic Communications Systems*, Third Edition, McGraw-Hill, New York.



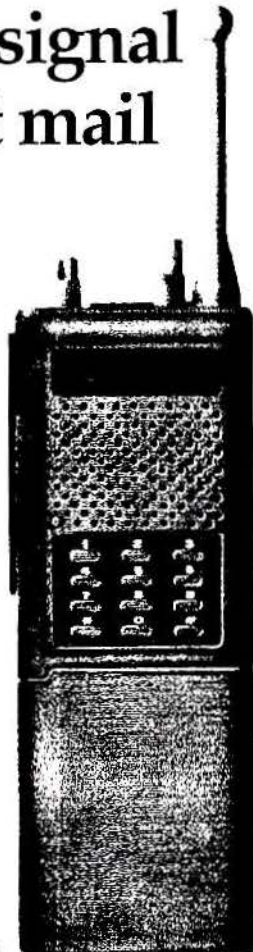
Send out a strong signal in your next direct mail campaign.

Choose the most responsive names in the mobile communications industry... For your next mailing, rely on *Mobile Radio Technology's* subscriber file to reach 24,106* qualified industry professionals.

Be sure your sales message makes an impact and reaches the real decision-makers in the mobile communications industry, put *Mobile Radio Technology's* subscriber file to work for you.

**Mobile Radio
Technology**

*6/92 BPA



For more information, contact:

Greg Hembree

MRT List Rental

P.O. Box 12901

Overland Park, KS 66282-2901

Call 913-967-1872

FAX 913-967-1897

**INTERTEC
PUBLISHING**

**DIRECT
MAIL**

LIST RENTAL SERVICE

We're making a name for you.

Circle (55) on Fast Fact Card

FINALLY...ONE CHARGER THAT CHARGES ALL BATTERIES



MANUFACTURED IN U.S.A.
BY W & W ASSOCIATES

By simply switching plug-in cups, the MasterCharger® will charge any Yaesu, Motorola, Icom, Kenwood, Alinco, etc. radio battery

MasterCharger I

- Can charge any Nicad Battery from 6v to 13.2v
- A constant current rapid charger utilizing a SANYO SI-101 Micro-processor base control unit which uses a negative delta V technique to determine when the battery is fully charged.
- Works with an AC adapter (115v AC or 220v AC) as well as with a cigarette lighter adapter cord in a car, boat, or plane.
- Can charge a battery in ½ hour to 2½ hours, then automatically goes into a trickle charge state.

MasterCharger II

- Can charge any Nicad Battery from 6v to 13.2v
- 115v or 220v AC adapter included.
- Utilizes a taper charge principle.
- Can charge a battery in 5 to 8 hours, then automatically goes into a reduced current state.

W & W ASSOCIATES

29-11 Parsons Boulevard • Flushing, N.Y. 11354

In U.S. & Canada Call Toll Free (800) 221-0732 • In N.Y.S. (718) 961-2103 • Fax: (718) 461-1978

ALL SPECIFICATIONS & PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE

Circle (56) on Fast Fact Card

Coaxial cable fusible link offers lightning protection

Although many radio communications systems include low-loss coaxial cable as a matter of course, small-diameter braided-shield cable may act as a fuse to prevent lightning surge currents from damaging electronic equipment.

By Richard Cartoscelli

Many times, the selection of an antenna system's coaxial cable is based on the need to minimize the amount of insertion loss.

Thus, a typical choice is a half-inch or larger diameter coaxial cable with a solid shield. Nevertheless, sometimes a small amount of signal loss is worth exchanging for additional lightning protection.

The photograph shows where a

Cartoscelli is a supervisory electronics technician with the U.S. Department of Agriculture, U.S. Forest Service in Nevada City, CA.

lightning surge current opened a connection between small-diameter, RG-58 coaxial cable and its UHF connector.

This cable was installed at a 5W VHF highband repeater located at about 8,500-foot elevation.

RG-58 cable is not double-shielded, and its loss is comparatively higher than for hardline cables. The antenna feedline length was about 25 feet from duplexer to antenna via a lightning arrestor.

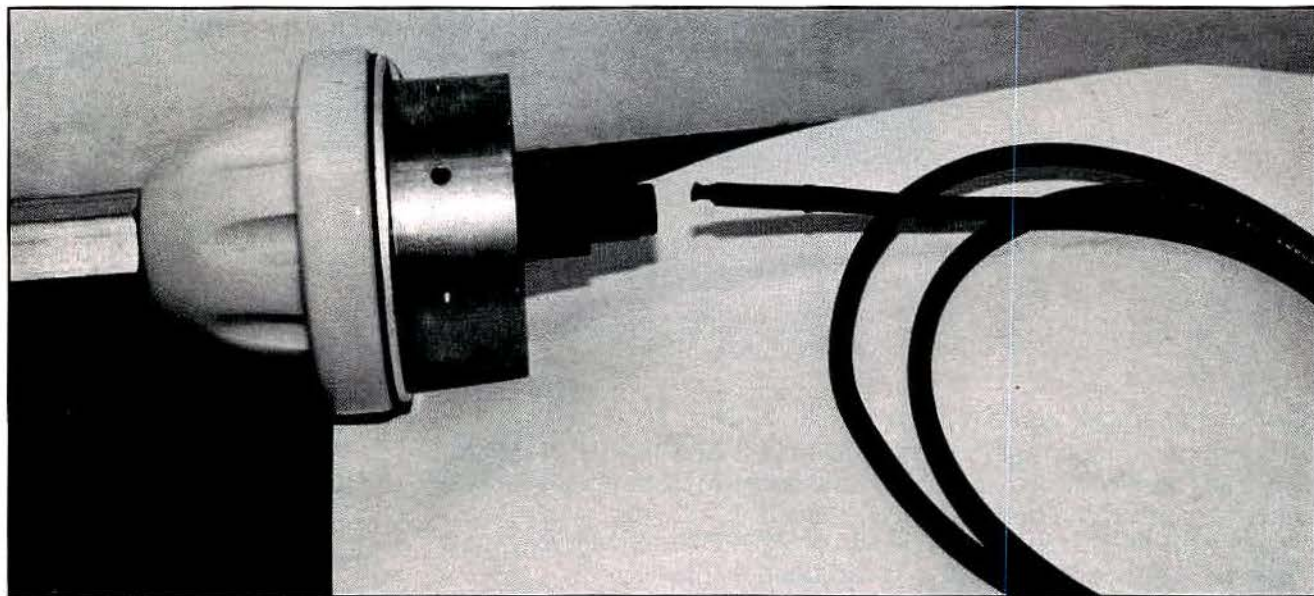
The site is fairly susceptible to lightning and receives an average of one direct strike every two or three years.

Notice that the RG-58 cable is fused open at the PL-259 connector.

When the lightning struck, the antenna was damaged beyond repair. Despite the antenna damage, neither the repeater nor the duplexer was damaged.

The replacement cost of the antenna and feedline (and, as a precaution, the lightning arrestor) is minimal, to say the least, compared to repairs that might have been necessary at the repeater, the duplexer or both, if the coaxial cable had not opened.

There may be specific applications where small coaxial cable can be installed to provide a fusible link that helps to prevent equipment damage when lightning strikes.



The gap shows where a lightning surge current opened a connection between small-diameter, RG-58 coaxial cable and its UHF connector. The feedline and the antenna it was connected to had to be replaced, but a repeater and duplexer served by the feedline were undamaged.



We cater to those who want choice sites.

When you have an appetite for choice antenna sites in California, no one can cater to your tastes like Meridian and Diablo.

For more than three decades we've been serving a buffet of antenna sites that stretches from Chico to the Mexican border. Together, Meridian and Diablo offer you 73 tasty locations to choose from.

These sites are among the most sought after and unique in the country. Many are rich with features such as stand-by power, air conditioning, security, and all-encompassing maintenance programs. Many sites offer conventional and trunked community repeaters, as well as engineered and combined antenna systems.

Now Meridian and Diablo have four new antenna sites on the menu: Flint Peak in the Rose Bowl area, providing coverage of Pasadena, Glendale, Burbank and the San Gabriel and San Fernando Valleys; Smith Hill, which covers Concord, Lafayette and Walnut Creek; Vaca South, covering the Fairfield/Vacaville-Marysville-Stockton triangle; and an extraordinary site atop the International Trade Center which blankets the greater Fresno area.

When it comes to service, our qualified staff and caring approach to antenna site management will have you coming back for seconds.



Meridian Communications

23501 Park Sorrento, Suite 213A, Calabasas, CA 91302-1355
(818) 888-7000 • Fax (818) 888-2857



DIABLO COMMUNICATIONS, INC.

1220 Brickyard Cove Rd., Ste. 200, Point Richmond, CA 94801
(510) 236-3700 • Fax (510) 236-3799

SANTA FE

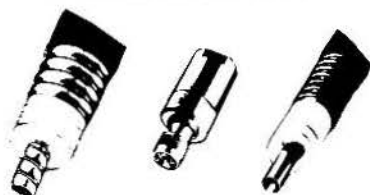
distributing

FOR ALL YOUR

CELWAVE

RFS

PRODUCTS



CELLFLEX® Closed cell foam dielectric with low density & high velocity

AVAILABLE IN

1/2" 7/8" 1 5/8"

LLFLEX® Foam - stranded inner conductor, excellent flexibility, low loss

AVAILABLE IN 1/2"

SANTA FE CAN CUT TO LENGTH & INSTALL CONNECTORS REELS or BOXES

FULL LINE OF

CELWAVE

RFS

**BASE ANTENNAS
MOBILE ANTENNAS
DUPLEXERS**

SANTA FE distributing

800-255-6595

9640 Legler

Lenexa, Kansas 66219

913-492-8288 Local

913-894-2136 Fax

WE CAN FILL YOUR NEEDS WHETHER LARGE OR SMALL

Technically speaking

100V ACROSS 50Ω = 200W = 0dB REFERENCE

DEVIATION = ±5kHz, TONE = 1kHz, MODULATION INDEX = 5.0

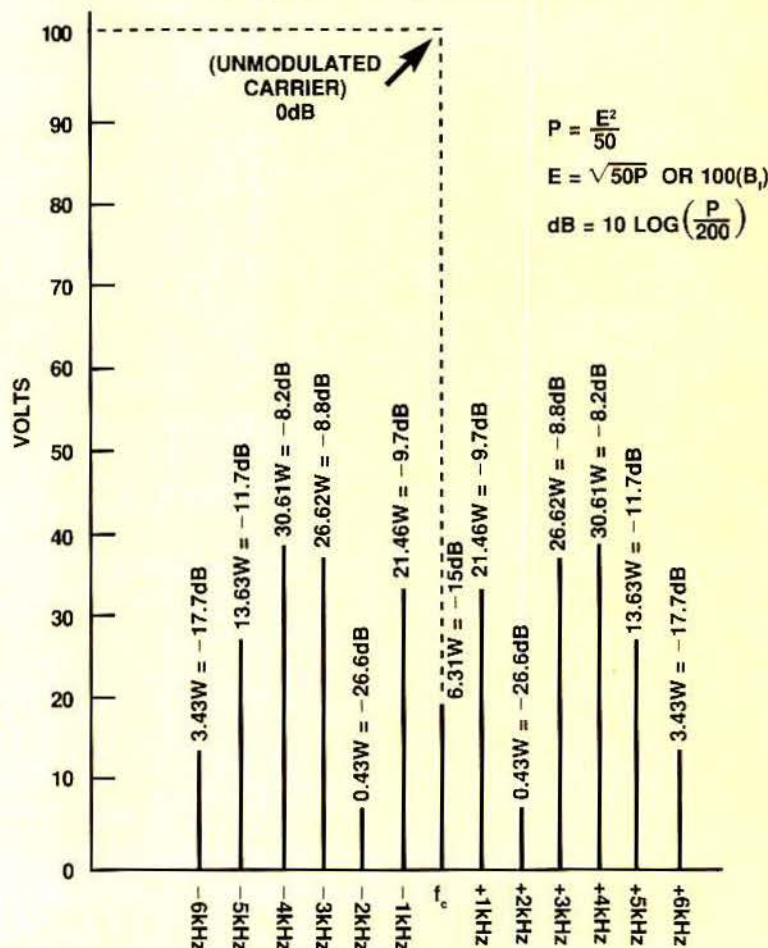


Figure 2. The frequency-modulated signal produced by the conditions depicted in Figure 1 produce the sideband spectrum shown above. Only the significant sidebands are included. Note that the carrier is down 15dB from its unmodulated level. If the deviation were $\approx \pm 5.5$ kHz with a 1kHz tone (to produce a modulation index β of 5.5), the carrier would null out com-

pletely and then rise again as the modulation index changes. This phenomenon can be used to calibrate deviation meters accurately by using a spectrum analyzer to locate the carrier null points. There are many values of modulation index (β) that will produce a carrier null (2.405, 5.52, 8.65, etc.).

(continued from page 8)

pairs at ± 6 kHz would be excluded from the received signal, causing distortion.

Notice in Figure 2 that the 0dB reference level is 100V. This represents a power level of:

$$100^2/50 = 200W$$

The power level of the carrier and each sideband is derived by finding the appropriate Bessel function in Table 1, then substituting into this formula:

$$P_s = \frac{[E_c(B_1)]^2}{50}$$

where



Synthesized, Field Programmable
11 channels
5 Watts VHF/UHF
8 Hr Battery Life
10 Hr Battery Available
Frequency Bands: 136-174
400-430, 450-512 MHz
Wide Band Operation:
VHF 15MHz/UHF 20 MHz
Scan
Tone Coded Squelch
Digital Coded Squelch
Two-Tone Sequential Decode
Rugged, Uni-Body Housing
Two Year Factory Warranty
Made In USA

VHF \$429 UHF \$449



Synthesized, Field Programmable
16 channels
30 Watts VHF 25 Watts UHF
Frequency Bands: 136-174
400-430, 450-512 MHz
Wide Band Operation:
VHF 15MHz/UHF 20 MHz
Scan
Tone Coded Squelch
Digital Coded Squelch
Two-Tone Sequential Decode
Rugged, Uni-Body Housing
Two Year Factory Warranty
Made In USA

VHF \$469 UHF \$499



*Portable comes with: battery, antenna, wall charger and belt clip
Optional accessories: DTMF keypad, speaker microphone, earphone
or headset, fast rate drop-in charger and carry holster*

*Mobile comes with: installation kit, hand microphone
and external speaker jack. Optional accessories: DTMF
hand microphone and 5 watt external speaker.*

DEAL WITH IT.

The new line of Patriot two-way radios really gives you something to deal with. Not only do you receive the benefits of a premium product line that's built in the USA by Ritron, but a product line with high dealer margins. And even more than that, you get strong dealer

support from the factory. It's true we have Patriot radio dealers worldwide, but right now a limited number of dealerships are still available. So take advantage of a truly patriotic deal, and call us at 1-800-USA-1-USA. **PATRIOT**
FAX: 317-846-4978. BY RITRON

Circle (59) on Fast Fact Card



Two Year Warranty applies to product sold in USA. Certain frequency bands special order

Technically speaking

P_S = sideband power in watts

E_C = the unmodulated carrier voltage

B_f = Bessel function

For example, to find the second sideband's power level, $f_C + 2f_M$, find the Bessel function B_f ; it is .0466. Sub-

stituting into the equation:

$$P_S = \frac{[100(.0466)]^2}{50} = 0.43W$$

All of the individual sideband power levels (through $f_C \pm 6f_M$) have been calculated as shown above and are listed in Figure 2. The decibel figures are included.

When you look at this particular signal on a spectrum analyzer display, you will notice that the individual sidebands' relative amplitudes may appear to be incorrect. Nevertheless, keep in mind that on the spectrum analyzer display, the scale is calculated in linear decibel units, typically 10dB/division.

If you first establish the 0dB unmodulated carrier reference point, you then can use the decibel figures in Figure 2 to compare with the spectrum analyzer display.

For example, you will notice that the carrier (at 5kHz deviation with a 1,000Hz tone) will be 15dB down from the unmodulated carrier (0dB reference level). When you add the power level of all of the individual sidebands plus the carrier, the total is:

$$\begin{aligned} &6.31 + 2(21.46) + 2(0.43) + 2(26.62) \\ &+ 2(30.61) + 2(13.63) + 2(3.43) \\ &= 198.67W. \end{aligned}$$

In terms of percentage of power, this figure represents:

$$P\% = 100 \left[\frac{198.67}{200} \right] = 99.33\%$$

where

$P\%$ = percentage of power in the sidebands + carrier

Because this is greater than 98%, all of the *significant* sidebands are included. The important point to remember is that when the carrier is frequency-modulated, the FM spectrum's total power does not change, it simply is redistributed.

If you were to connect a very selective 5kHz-bandwidth filter centered at f_C between the transmitter producing the spectrum shown in Figure 1 and a wattmeter, the wattmeter would read only the *sum* of the powers in the carrier and the first two sideband pairs. This would be:

$$6.31 + 2(21.46) + 2(0.43) = 50.09W$$

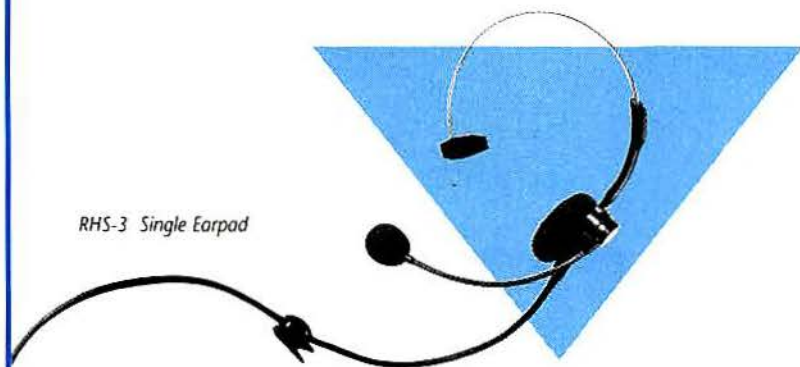
representing approximately 25% of the total spectrum power. If the modulation were removed, leaving only the carrier,

Take Your Hands Off Your Radio!



Maximize your performance with the ease and comfort of hands-free radio operation! DTC's most advanced line of communication accessories are built to perform in the toughest conditions. Experience Engineering Excellence!

RHS-3 Single Earpad



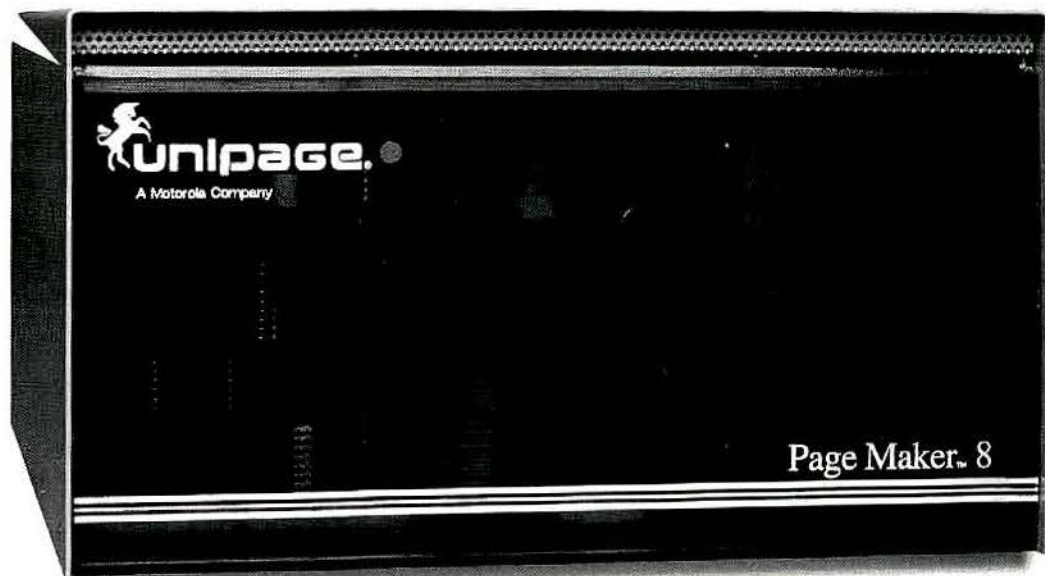
**DYNATECH
TACTICAL
COMMUNICATIONS, INC.**

16 Hampshire Dr., Hudson, NH 03051 **1-800-233-8639**

Circle (60) on Fast Fact Card

NEW!

Sheer Genius



Big Terminal Features in a Small Paging Terminal

For Smaller Markets, Customer Owned Paging, Health Care or those Special Alpha Applications.

Unipage now offers Customer Owned Paging companies and those with smaller paging demands, a paging terminal that has many of the features normally found only on larger terminals. And it's affordably priced. Here are the standard features and some of the benefits that come with Page Maker 8.

Page Maker 8 Standard Features:

- 2000 Subscriber Number Capacity
- One Channel Output
- A Quad Store Card for Voice Paging
- A VP8 Card for Caller Prompting
- A Dual Trunk Card (two trunk inputs)

Profit from Big Terminal Features

- Use 2 Tone, 5 Tone, POCSAG 512, 1200 or 2400, GSC, NEC D3, NCA, or MBS pagers.

A Few Benefits of Owning a Unipage

- Numeric, Alpha, Tone or Voice paging.
- Interfaces with PURC, Quintron and other transmitters.
- Hot Card Maintenance--remove or install any card while the system is operational. It's convenient, and you don't have to power down and lose pages while the system is off the air.
- System is expandable to four trunks by adding an additional card. By adding other optional cards, your system can grow as your needs grow. And, all of the cards are transportable to an M15 chassis for future growth!

For more details, call Unipage at the number listed below. We will be happy to show you how the Page Maker 8 is the wise choice for your paging needs.



unipage

A Motorola Company

1510 N. Hampton
DeSoto, Texas 75115
(214) 224-3509
1-800-367-2864
FAX (214) 228-1430

Sold through Motorola Dealers or directly through Motorola and Unipage.

Circle (61) on Fast Fact Card

© Unipage, 1993

Technically speaking

er, the wattmeter then would indicate the full 200W.

Fortunately, the greatest power distribution from the speech waveform lies in the lower frequencies. For lower frequencies, the sidebands are spaced closer and thus, for a given modulation index, occupy less bandwidth.

The average modulation index of a typical complex speech waveform might be from 2 to 2.5. Compressed speech waveforms would produce a higher average modulation index than uncompressed speech waveforms.

The preceding discussion ties in directly with the measurement of the FM receiver's bandwidth. If the bandwidth is too narrow to pass the FM signal's significant sidebands, then serious signal quality degradation results. Two methods of measuring FM receiver bandpass response are described.

The term *modulation acceptance bandwidth* refers to the deviation level at which the signal is degraded by 6dB as referenced to the 12dB SINAD sensitivity input level.

For example, if the 12dB SINAD sensitivity level is $0.25\mu\text{V}$, then the input signal level is increased by 6dB to $0.5\mu\text{V}$, and then the deviation is increased from 3kHz to a level that returns the SINAD meter reading to the 12dB SINAD level. This is the 6dB bandwidth of the receiver.

This procedure for checking the modulation acceptance bandwidth is described in the Institute of Electrical and Electronics Engineers (IEEE) publication *IEEE Test Procedure for FREQUENCY-MODULATED MOBILE COMMUNICATIONS RECEIVERS* (IEEE Std. #184-1969) para. 4.1.1.1.3, p. 6. Typically, a properly operating receiver yields a test result of $\pm 7.0\text{kHz}$ to $\pm 7.5\text{kHz}$ modulation acceptance bandwidth.

Minimum usable bandwidth

The Electronic Industries Association (EIA) standard *MINIMUM STANDARDS FOR LAND MOBILE COMMUNICATION FM OR PM RECEIVERS, 25-947 MHz* (EIA-204-C) para.

8.0, p. 11, describes a slightly different method of establishing the 6dB bandwidth.

As does the IEEE method, the EIA method uses the 12dB SINAD method of establishing the 6dB bandwidth. Moreover, the EIA method uses the 12dB SINAD signal input level as a reference (with a *center-frequency* signal).

The signal generator level then is increased by 6dB. Next the signal generator frequency is *increased* until the SINAD meter again indicates 12dB SINAD. The signal generator's frequency then is recorded.

Next, the signal generator's frequency is tuned below the center frequency until the SINAD meter again indicates 12dB SINAD. The signal generator frequency is recorded.

The frequency difference (Δf) between the center frequency (f_c) and the lower frequency (f_L) and the difference between the upper frequency (f_U) and the center frequency (f_c) are calculated. The smaller difference is the *minimum usable bandwidth*.

The EIA standard further states: "The minimum usable bandwidth shall not be less than one-half of the maximum specified receiver frequency stability in kHz (but at least 40% of the rated system deviation.)"

For a system deviation of $\pm 5.0\text{kHz}$, the minimum Δf should be no less than $\pm 2.0\text{kHz}$. Remember, the generator signal is being deviated at $\pm 3.0\text{kHz}$ already, so that this deviation level has to be considered along with the frequency displacement (Δf).

The procedures described above are similar in principle but different in methodology. The modulation acceptance bandwidth test prescribed by the IEEE standard is easier to carry out on the workbench and is more commonly used by manufacturers in specifying receiver bandwidth and by technicians in running the test.

Both methods yield valid results, but the one you use should be dictated by the one used by the manufacturer in writing the specification sheet.

When receiver alignment and repairs are done, it should be standard practice to check the modulation acceptance bandwidth or minimum usable bandwidth, just as you would check the 12dB SINAD sensitivity.



VERTEXTM MOBILES & PORTABLES

Now in stock at Henry Radio—the popular new Yaesu "Vertex" line.

- FTL-2011 VHF and 7011 UHF mobiles
- FTH-2070 Dual-Band Portable
- FTH-2008 VHF and 7008 UHF Portables
- FTH-2009 VHF and 7009 UHF Low Cost Portables



**HENRY
RADIO**

2050 S. Bundy Drive
Los Angeles, CA 90025
Toll Free: 1-800-877-7979
Or: 1-310-820-1234
FAX: 1-310-826-7790

ALSO IN STOCK:

AEA DATA
AOR
ASTRON
BECKMAN
BIRD
CENTURIAN
CUSHCRAFT
FANON
HENRY
HOXAN
ICOM
JABRO
KANTRONICS
LARSEN
MAXON
OPTO
PIPO
RADIUS
TEMPO
UNIDEN
YAESU



Circle (62) on Fast Fact Card



NEW ORLEANS

"LAISSEZ LES BON TEMPS ROULER"

59th APCO Annual Conference & Exposition August 8 - 13, 1993



Exhibits • Panel Discussions • Seminars • Educational Presentations

The Conference is the world's largest gathering of public safety communications professionals from law enforcement agencies, fire departments, 9-1-1 centers, emergency medical services, forestry and conservation agencies, emergency management and disaster preparedness departments, highway maintenance, and other federal, state and local government agencies.

For exhibit and attendee information contact Ann Armitage or Pat Daniels
800/949-2726
(in Canada or Florida call 904/322-2500)

Database provides FCC tentative selectees

The National Association of Business and Educational Radio (NABER) and Interactive Systems (ISI) have joined to bring FCC information-based services and products to the land mobile communications market.

An enhanced database to help interested parties analyze the potential licensees and their market areas in the 220MHz-222MHz

band is available. The database provides name, address, phone number, FCC file number, and a variety of transmitter information such as coordinates, city, antenna height, ground elevation and ERP. To learn more about ISI's interactive access to FCC license databases, call the company's customer service department at 703-812-8270.

American Mobile Radio Association organized to fight Part 88

A group of land mobile radio dealers, service shops and system users have organized the American Mobile Radio Association (AMRA), Washington, DC, to fight provisions in the FCC's Part 88 Refarming Proposed Rule Making. Former Ambassador Richard N. Holwill, executive director of AMRA, said "AMRA has been formed to press the FCC, the courts and the U.S. Congress to preserve the land mobile business in the 150MHz-512MHz spectrum."

Provisions of Part 88, as proposed, would limit applications for large SMR trunked systems to corporations with sales in excess of \$1 million and 10 repeaters in the same market area.

Holwill states, "Every radio in use today under Part 90, in the 150MHz-512MHz bands, will become obsolete in 1996. Tighter frequency stability standards will be imposed which probably cannot be retrofitted economically in existing equipment. Adjacent channel interference will render existing receivers unusable. Additionally, the power of every repeater or base station at higher altitudes will be cut to as little as 1W, limiting the coverage to an area too small to be useful."

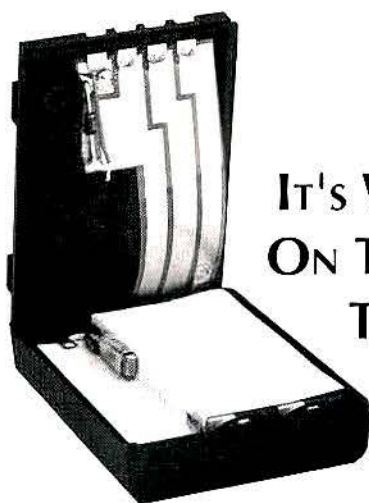
AMRA has established an information line: 800-769-AMRA. The association's address and telephone number are P.O. Box 33847, Washington, DC 20033; 202-547-6545.

Trademark infringement suit filed against Fleet Call

Silke Communications, Eugene, OR, has filed a trademark infringement lawsuit against Fleet Call, Rutherford, NJ. The suit, filed in San Francisco's federal court, seeks all of the New Jersey company's profits under the "Fleet Call" trademark, an injunction against further use of the name and the destruction of all business and promotional documents and materials bearing the mark.

Silke has owned a federal registration of the trademark "Fleetcall" since 1980. Silke uses the mark in providing two-way mobile communications goods and services, including specialized mobile radio (SMR) systems, to customers. Silke's goods are sold nationwide, and its services are offered primarily in Oregon.

Fleet Call, formed in 1987, is the second largest SMR operator in the United States with accumulated licenses for approximately 1,557 channels at 800MHz and 460 channels at 900MHz.



**IT'S WHAT'S
ON THE INSIDE
THAT COUNTS!**

It's the way an Alexander® battery is constructed inside that sets it apart from other batteries. Our state-of-the-art manufacturing methods put us at the forefront of the battery pack technology and innovation.

Our weld points feature steel to steel, not nickel to steel or other metals. We have a minimum of four welds per cell. This allows the strongest weld possible and insures a strong internal structure.

Alexander's unique patented flexible circuit boards reduce the number of internal connections to improve reliability and protect internal structure from unexpected bumps and falls.

We use the highest grade nickel-cadmium cells to ensure maximum talk-time.

Our commitment to research and development and rigid quality control standards keep us on the leading edge of the battery industry.

We are so confident in our quality products that we back them with the best warranty in the industry - one full year.

Choose an Alexander battery.

It performs as well on the inside as it looks on the outside.



Alexander® Batteries

1-800-388-8314

SOMETHING'S IN THE AIR...

And on the road. In the field. On-site.

It's you.

Your business.

Your livelihood.

We know mobile communications
are essential to your business.

That's why we stock a complete
line of conventional and
mobile communications
equipment from a variety
of manufacturers such
as Midland LMR.

And you're never
left in the dark when
it comes to support
because we respond
immediately to your needs.

We're here for you.



**GENERAL
COMMUNICATIONS**

DISTRIBUTORS OF MOBILE COMMUNICATIONS EQUIPMENT

Because your business takes you everywhere.

5157 Anton Drive • Madison, WI 53719

FAX 608 274-2080 • 608 271-4848

800 356-3200

MIDLAND LMR
LAND MOBILE RADIO

Circle (65) on Fast Fact Card

Dealers Welcome

SCI installs paging packages to more than 47,000 pagers

Subscriber Computing (SCI), Irvine, CA, is installing Communications Resource Manager (CRM), an integrated paging management software system, for three clients in Northern California and the Pacific Northwest. One client, Cook Telecom, San Rafael, CA, provides radiopaging and voice mail services in eight cities in California, Oregon and

Washington. Another client, Pass Word, Spokane, WA, serves paging customers in central and eastern Washington and northern Idaho. The third client, Telepage Communications, Sacramento, provides cellular and voice mail services to Sacramento, the San Francisco Bay area and the San Joaquin Valley.

Hewlett-Packard sponsors radio test workshops

Hewlett-Packard, Spokane, WA, will hold radio test workshops across the United States featuring the HP 8920A RF communications test set. The workshops include an overview of features and benefits; signaling encoding and decoding; using the spectrum analyzer and tracking generator; computer-aided cellular phone testing; and fully automated trunked radio measurements. Call 800-344-3802 for site information; 800-765-9200 to register.

Moducom supplies consoles for emergency communications

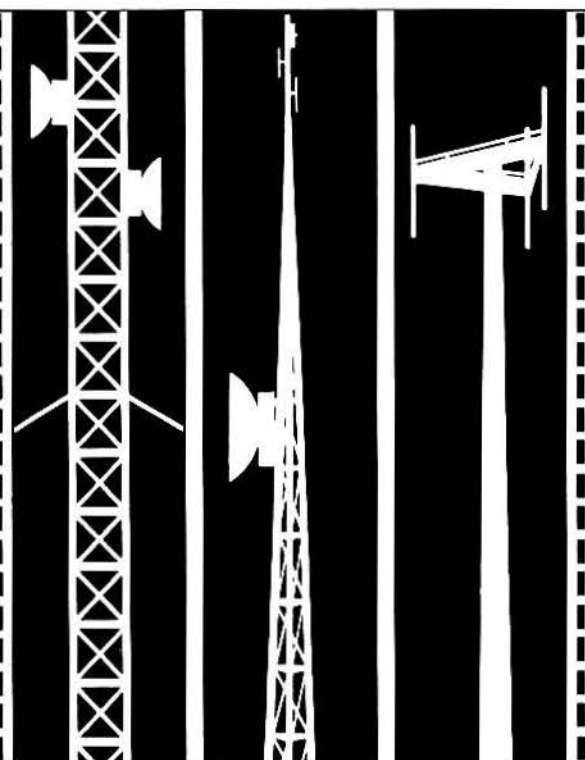
Modular Communications Systems (Moducom), North Hollywood, CA, is supplying its Ultra-Com PRO microprocessor-based communications control system to the Pueblo, CO, Emergency Operations System. The system is composed of 11 console positions.

Dataradio supplies modems for cable TV mobile data application

Dataradio, Atlanta, has entered into a value-added reselling (VAR) agreement to supply its vehicle information series (VIS) mobile data modems to Arrowsmith Technologies, Austin, TX, for integration into its Fleetcon-Cable system for cable television market. Fleetcon-Cable is a fleet management solution specifically designed for the cable television industry and is comprised of vehicle location and mobile data communication systems on a fault-tolerant network of dispatch and management workstations. Dataradio is providing the 24FS series mobile radio modem and base station data link controllers.

Paducah, KY, picks Motorola to supply trunked radio system

The city of Paducah, KY, has purchased an 800MHz Smartnet enhanced trunked radio communications system from Motorola Land Mobile Products, Schaumburg, IL. The FCC has awarded a license to the city of Paducah for six 800MHz frequencies, five of which will be fully trunked at the Paducah-McCracken County Communications Center, serving the police, fire and public works departments. The other one will be installed at the Paducah Gaseous Diffusion Plant owned by the U.S. Department of Energy and operated by Martin Marietta Energy Systems. The system is valued at more than \$1 million.



Towers & Poles

- Free Standing design to 400'
- Tubular Steel to 250'
- Guyed to 1000'

In-house engineers design poles and towers to your specifications. Full range of finishes with installation and leasing available.



VALMONT

Valmont Industries, Inc.
Valley, Nebraska 68064
(402) 359-2201

FREE TOWER LITERATURE



☐ **PLEASE fill in and mail this coupon for free information on communication towers.**

NAME _____

COMPANY _____

MAILING ADDRESS _____

CITY _____ STATE _____ ZIP _____

OFFICE TELEPHONE () _____

How can Bendix/King afford to offer a **5-year warranty?**

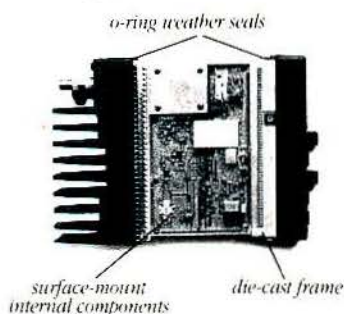


Simple.
We make the industry's best-built radio.

We designed the EMV mobile UHF radio to elevated standards, then set our manufacturing and testing standards even higher. The result: total confidence. That's why we cover the EMV with the land mobile industry's best warranty: *five full years* at no additional charge.

The EMV's extruded housing, die-cast frame and surface-mount internal components afford extreme rigidity and resistance to vibration. Its rugged construction meets demanding MIL-SPECs 810 C, D and E.

Extensive testing of components and circuits ensures reliability. *Every* unit withstands an 8-hour transmit/receive temperature-cycling burn-in test before acceptance as a finished product.



And we haven't sacrificed power, performance or flexibility. We've put features and options under high-performance digital control, written into system software, so there's never a need to open the case for adjustments.

The EMV's bright vacuum-fluorescent display shows easy-to-read alphanumeric characters. Power output is programmable from 10 to 40 watts. Programmable control buttons put a custom menu of functions at your fingertips. A 67-MHz bandwidth covers 403 - 470 MHz with no degradation in specification.

The EMV mobile offers advanced features for today and adaptability for the advances of tomorrow. And now, it carries *the industry's longest warranty.*

Because this is the industry's best-built radio.

1-800-648-0947

BENDIX/KING
WORLD CLASS RADIOS™

2920 HASKELL AVENUE, LAWRENCE, KS 66046 • (913) 842-0402 • FAX (913) 841-0287

Circle (67) on Fast Fact Card

AlliedSignal
AEROSPACE

Get Control.



Remote Control, of up to 16 Channels. Radius M200 or Maxtrac 300 Series Radios.

The CPI model MCR10 remote and MCR10P interface panel will allow you to remote control Radius or Maxtrac radios, up to sixteen channels, over any two wire voice grade circuit.

The MCR10 remote control system provides LED displays for remote channel indication, channel up and down buttons, PTT indicator, on-hook PTT capability, monitor button and indicator, intercom capability between parallel remotes and the radio, scan control button and indicator for those radios so equipped and speaker volume control.

Features

- Simple installation - No soldering, cutting or crimping.
- Provides remote channel indication.
- Does not require B308 option.
- Remote transmissions heard over radio speaker.
- Radio transmissions monitored on remote speaker.
- Uses any two wire voice grade circuit.



1186 Commerce Drive • Richardson, TX 75081
(214) 437-5320 • FAX (214) 437-5360 • (800) 869-9128

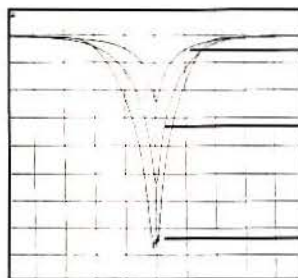
Circle (68) on Fast Fact Card

TUNABLE NOTCH FILTER

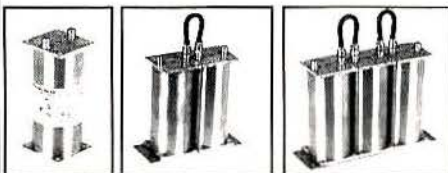
The 6367 series comprises 6 separate tunable notch filters, each of which covers an approximately 2:1 frequency range with adjustable 3 dB bandwidth. A coaxial or helical resonator is tuned with high Q air trimmers to produce a relatively deep notch at narrow bandwidth. Available for tuning ranges of:

22 - 35 MHz
30 - 50 MHz
50 - 108 MHz
108 - 216 MHz
216 - 450 MHz
450 - 900 MHz

Ask for our NEW Mobile
Phone Catalog MP/92!



Response of Single, Double
and Triple Cavity assemblies
adjusted to the same
3 dB bandwidth.



MICROWAVE FILTER COMPANY, INC.
6743 Kinne St. • E. Syracuse, NY 13057
800-448-1666 • 315-437-3953
FAX: 315-463-1467 • Telex: 249-613

Circle (69) on Fast Fact Card

News

IBM selects Racotek's data, voice communication services

IBM has selected Racotek's RacoNet wireless communication services as one of several that customers can use with IBM's TouchMobile system. TouchMobile is a rugged, wireless device that fits in one hand and allows mobile workers to collect and receive data electronically in the field.

Premier GPS signs on as NovAtel distributor

NovAtel Communications, Calgary, has signed a one-year, \$1 million distribution agreement with Premier GPS of Calgary, Alberta. The non-exclusive agreement is for low volume, worldwide distribution of NovAtel's GPSCard and GPSAntenna. Premier also will customize the products for its clients by developing integrated personal computer and communications links.

MobileComm, McCaw develop joint marketing project

MobileComm, Ridgeland, MS, has joined forces with McCaw Cellular Communications, Paging Division to sell pagers in retail outlets. MobileComm currently markets its PersonalPager in more than 10,000 retail outlets including Wal-Mart, Radio Shack, Service Merchandise, Pep Boys, Standard Brands, Lechmere, Hecht's Department Stores, Rich's Department Stores and Hi-Fi Buys. McCaw will bring an additional 16 of the top 100 markets to MobileComm's current retail program. The expansion of the PersonalPager retail division represents coverage to every major metropolitan area for MobileComm.

Project 25 proceeds to TIA

The Project 25 Steering Committee voted unanimously Jan. 15 to forward the Digital Radio Technical Standards Report to the Telecommunications Industry Association (TIA) for consideration as an interim standard.

The Steering Committee is composed of representatives from the Associated Public-Safety Communications Officers (APCO), the National Association of State Telecommunications Directors (NASTD) and the federal government. The report was presented to Stuart Meyer, TIA-25 chairman, who will begin the formal process of circulating the proposed standards to manufacturing members of TIA for review, comments and official vote. The process is anticipated to take 2 to 3 months, and then the report will become an interim standard as further refinements are made.

CES

**TRUNK YOUR
COMMUNITY REPEATERS WITH ...**

LANCER

**TRUNK YOUR
CONVENTIONAL
RADIO EQUIPMENT
WITH AFFORDABLE,
FEATURE-RICH
LANCER NETWORK
SYSTEMS.**

When you are ready to add advanced trunking technology to your conventional radio systems, isn't it nice to know that the technology is ready for you?



The Local Area Network Central Exchange Radio network provides many of the features found in trunked radio systems and cellular telephone service. Now you can easily "trunk" your existing radios, both mobile and handheld, already in service. A LANCERnet terminal on each repeater and a LINC module in each portable or mobile radio are

the only requirements for setting up your LANCERnet system. Call or FAX us today for complete information on the powerful LANCERnet system.



- Automatic Channel Allocation
- Intersystem Security & Privacy
- Validate Users by Tone, ANI, or Both
- Up to 2,000 Users Per Channel
- Conference and Group Calling
- Two Tone Paging
- Talk Back Paging
- Multi-level Priority User Override
- Full Remote System Control
- On Board Call Accounting
- Direct Inward Dialing Option
- Remote Delinquent Subscriber Disable & Enable
- Out of Range Conventional Operation



**Communications
Electronics
Specialties, Inc.**
931-218 South Semoran Blvd.
Winter Park, Florida 32792 USA
Telephone: (407) 679-9440
Toll Free: 1-800-327-9956
FAX: (407) 679-8110
Circle (70) on Fast Fact Card

CES



TOWER STRUCTURES, INC.

25
YEARS!

1993 marks the 25th year in business for **Tower Structures, Inc.** With thousands of communications installations successfully completed, we bring you the benefit of a quarter century in the turnkey communications business. Our team of seasoned professionals offers a single-source responsibility for design, manufacturing, and construction of your communications site.

ENGINEERING

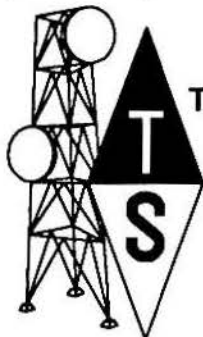
Licensed Civil and Structural engineers, supported by CAD drafting, are part of our **full time** staff. Their familiarity with the codes and standards of the telecommunications industry, along with a 25 year "library" of drawings and calculations, allows them to quickly provide designs suited to your needs. Our unique software allows us to produce customized designs at the price of standard designs. We believe in designing solutions to your problems, not force fitting your problem into canned solutions.

MANUFACTURING

•**Towers, Monopoles, Roof Mounts, Wall Mounts.** Certified welders, certified steel, and comprehensive quality control meets the rigorous requirements necessary to be a City of Los Angeles licensed fabricator and offers you the assurance of a quality product.
•**Equipment Shelters.** We offer a complete line of shelters, including concrete and framed shelters, with a variety of architectural finishes inside and out.

CONSTRUCTION

Tower erection, foundation installation, site grading, generator and fuel tank installation, construction of site-built buildings, road construction, retaining walls - everything necessary to get your site up and running. We'll even install and test the antennas and cables, put in the site grounding, and build the fence.



TOWER STRUCTURES, INC.

1869 Nirvana Avenue
Chula Vista, CA 91911
(619) 421 - 1181
FAX (619) 421 - 0533

Circle (71) on Fast Fact Card

News

Motorola acquires minority interest in Racotek

Motorola, Schaumburg, IL, has exercised its option to acquire a minority option in Racotek, a Minneapolis-based wireless mobile data communication services company. Terms were not disclosed. Motorola decided to acquire the minority interest after Racotek successfully developed and tested a RacoNet mobile data communication service using Motorola's trunked radio interface. Racotek has moved immediately to the next testing stage using customers with the RacoNet service on Motorola systems in Boston and New Jersey.

Kustom Signals wins lawsuit

A federal district court in San Francisco has absolved Kustom Signals, Lenexa, KS, of liability in the first of 13 related product safety cases to reach trial naming Kustom as a defendant.

The complaint alleged that the company's police radar products caused cancer in an officer who used them. Nine other similar cases filed against Kustom during the past two years have been dismissed on the motions of the plaintiffs without settlements, and three other are pending.

Company president William Ruppert said that thousands of law enforcement officers had been needlessly alarmed by unfounded allegations of safety risks involving police radar products. "Neither Kustom nor any other police radar manufacturer involved in similar litigation has been found guilty of allegations related to the safety of their equipment," a statement issued by the company reads.

Pinpoint uses satellites, FM transmissions for GPS service

Magnavox Electronics Systems, Torrance, CA, and CUE Network, Irvine, CA, have developed a strategic alliance and developed Pinpoint, the first nationwide high-accuracy satellite positioning and location network. The service will permit a user to determine his geographic position within a few feet by using signals from U.S. navigational satellites and transmissions from local FM radio stations.

Following the initial introduction in Los Angeles, the service will be expanded to as many as 50 additional cities across the United States in 1993. On-air trials have already begun in Houston and New Orleans.



Keeping current about radio regulations that affect your business

By Alan S. Tilles, Esq.

During several meetings among smaller specialized mobile radio (SMR) system operators in markets where one or more large SMR system operators have applied for FCC rule waivers to build wide-area, digital systems, some of the smaller operators expressed several concerns, including the beliefs that:

(1) The wide-area filing is anti-competitive.

(2) Short-spacing, even if it is based on the most conservative standards, should not be permitted. (Short-spacing refers to placing SMR transmitters less than 70 miles apart [less than 105 miles in some areas] on co-channels. When authorized, short-spacing is based on an engineering calculation of potential interference.)

(3) Short-spacing will mean that the existing operator will not be able to move a system even if necessitated, for example, by a lease expiration or a tower collapse.

Lack of awareness

Some of the smaller SMR system operators apparently have not kept abreast of the changing SMR environment.

For example, they were unaware of the FCC's decision regarding wide-area systems and short-spacing.

Some did not know that the National Association of Business and Educational Radio (NABER) had assembled a technical committee that already had proposed that short-spacing should be based on a 40dBμ/22dBμ desired/undesired signal overlap ratio criterion. The committee's proposal has gained acceptance as having met the SMR industry's and the FCC's need for a criterion.

Others did not know that NABER had successfully lobbied the commission to protect existing short-spaced operations, a lobbying effort that led to the adoption of FCC rule Section 90.621(b)(6).

Still others were not aware that the FCC did not consider the digital, wide-area applications that have been filed to date as having raised anti-competitive issues.

It seems that the lack of awareness primarily is because Fleet Call, the Rutherford, NJ-based multiple SMR operator that filed the first FCC applications for digital systems, did not file any applications in these particular smaller SMR system operators' markets. Therefore, these

operators had not felt the need to become involved before the most recent round of application-filing among other multiple SMR operators.

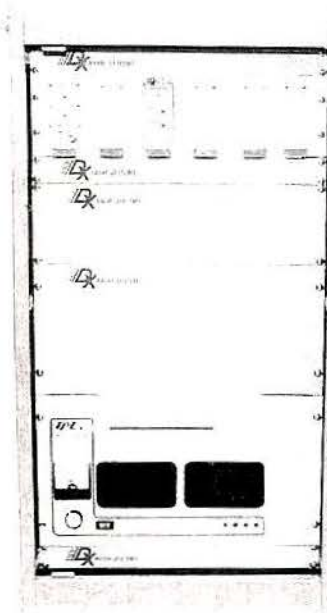
How to stay informed

With the effects on the radio communications business that will be caused by new 220MHz band systems, personal commu-

nications services and spectrum refarming below 800MHz, mobile communications equipment dealers and system operators must pay more attention now than in the past to rapid industry developments.

Given the abundant press coverage, trade organization activities and industry conference seminars, there are many opportunities to keep current about wide-area

PAGING TRANSMITTERS DXP - SERIES



- VHF/UHF 100% SOLID STATE
- 100 TO 500 WATT OUTPUTS
- DIRECT FM - TONE, VOICE, DIGITAL MODULATION
- 100% DUTY CYCLE

The DXP Series from DX Radio Systems is a versatile family of rugged, dependable paging transmitters. The DXP Series comes with full metering, modular construction, and expandability to provide channel monitoring and link control receivers as well as optional wireline control inputs. DXP Series transmitters may be controlled by paging encoders providing any combination of tone, voice and digital formats. Contact a sales representative in your area or call DX Radio Systems and talk with our applications engineer about your requirements.



3370 San Fernando Road, Unit 206
Los Angeles, CA 90065
(213) 257-0800 • (800) 447-6937
FAX (213) 254-3210

Tilles, MRT's regulatory consultant, is a partner in the law firm of Meyer, Faller, Weisman and Rosenberg, P.C., Washington, DC.

Regulating technology

SMR issues and the mobile marketplace in general.

Mobile communications entrepreneurs should take the following steps to stay informed:

► *Read industry publications.* In addition to articles about the latest equipment, review the regulatory columns. They may contain some ideas to help you to expand and protect your business.

► *Join an industry trade association,* if

you are not already a member. The information that you will receive on a regular basis is specifically targeted to your needs.

► *Attend selected industry conferences.* Although the International Mobile Communications Expo offers a good opportunity to see new products and to talk with distributors, the large number and variety of participants often makes getting up-to-date information difficult. On the other hand, trade association conferences

are narrowly focused and have a focused audience that permits extensive discussions with knowledgeable people. These discussions yield a tremendous "bang for the buck" that helps an operator to obtain information that may be vital to continued success.

Although some might argue that the expense of attending conferences is an obstacle, failing to attend the right conferences ultimately costs more in terms of an operator's ability to be "ahead of the curve," anticipating market developments and responding to trends.

For example, NABER held a one-day seminar in Dallas. A half-day was devoted to reviewing the current status of digital, wide-area SMR systems, and a half-day was devoted to the issue of spectrum refarming below 800MHz.

Participants learned how to protect their existing businesses, as well as what steps to take now to take part in future developments that may stem from digital SMR and spectrum refarming. Attendance was far

*... trade association
conferences are narrowly
focused and have a
focused audience that
permits extensive
discussions with
knowledgeable people.*

greater than anticipated, demonstrating a high level of interest in these topics.

Moreover, the most important aspect was the astounding level of positive response from the participants. Many of them asked for additional meetings on these subjects and suggested other topics they thought were worthy of similar treatment.

► *Get involved.* Every trade association needs member participation. If you cannot find time to serve on a committee or board, write well-crafted, thoughtful letters to your association(s) to let them know your position on critical issues. Then your comments can be considered when decisions are made by the associations' various boards and councils.

Following these steps will help you to place your business on a firm, stable economic footing and to provide a springboard for growth.



Custom Designed Dispatch & Control Centers

Featuring:

- CAD Design Techniques
- Welded Tubular Steel Framework
- Tough, Baked-On Epoxy Coating
- Color-Coordinated with New or Existing Decor
- Premium-Quality Laminates & Hardwood Trims
- Correct Ergonomics
- Superior Craftsmanship

STS designs and builds high-quality, custom dispatch centers for any application. Using advanced modular techniques for superior stability and longevity, along with premium materials, STS furniture is the best value in the industry.



Skaggs Telecommunications Service, Inc.
5290 South Main • Salt Lake City, Utah 84107
(801) 261-4400 • Toll Free: 800-879-1787

Circle (73) on Fast Fact Card

INTELLIGENT NETWORK SUMMIT

Sponsored by
Telephony Magazine, Bellcore,
Cellular Business Magazine, and
Mobile Radio Technology Magazine

*June 7-9, 1993
The Fairmont Hotel
Chicago*

Fax This Page to 312/922-1408 Attn: Tina Rubin

NAME

TITLE

COMPANY

DIVISION/DEPARTMENT

COMPANY ADDRESS

CITY/STATE/ZIP

OFFICE PHONE

FAX

☐ Please send conference information

☐ Please send exhibitor information

Or call Tina Rubin at 800/458-0479 or fax 312/922-1408

Cellular Business • 55 East Jackson Blvd. • Suite 1100 • Chicago, Illinois 60604

Readers' choice

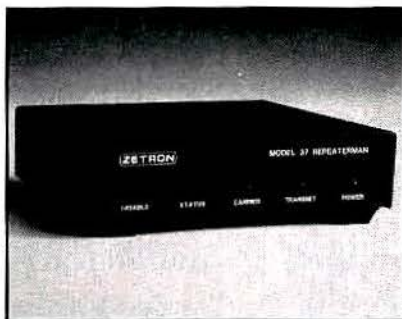
Of all the new products and services in the August 1992 issue, the ones reprinted here generated the most reader requests for additional information. If you missed them the first time, here is your opportunity to acquire more information on them: Just circle the corresponding Fast Fact Card number on the card found in the back of this issue and mail the card to us.

Watch features paging capabilities

A combination watch/pager called a Piepser contains the smallest paging device made. The Piepser has four distinct tones activated by specified telephone numbers to alert the wearer and allow for instant caller identification. The **Swatch** and **MobileComm** watch/pager can be switched off when the wearer does not want to be contacted and switched into a silent mode when necessary. When in silent mode, the Piepser stores incoming signals for later retrieval.

Circle (501) on Fast Fact Card

Repeater controller accommodates 1 or 2 user groups



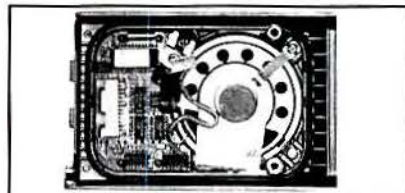
Model 37 Repeaterman from **Zetron** works with radio systems having one or two separate user groups. The repeater controller can encode and decode two user-selectable CTCSS tones. It includes remote DTMF programming, cross-tone encoding, Morse code ID, programmable courtesy beep and low standby current drain. The unit may be used for establishing an emergency repeater out of mobile radios.

Circle (500) on Fast Fact Card

Voice encryption module provides 4 user-selectable codekeys

The ST-26 Mobilecall voice encryption module from **Selectone** fits the Radius P200 and Motorola HT600 radios. The module has more than 4 billion available codekeys and four user-selectable codekeys for use with as many as four different groups on the same RF channel.

Circle (502) on Fast Fact Card



Hold On To Your Money!

Panasonic Numeric
VHF, UHF, 900
MHZ Numeric
Display Pager



WHY tie up your capital resources in excessive inventory? Buy one or 1,000. With no minimum order, VCP lets you buy only the stock you need. And our same day shipping* gets it to your shelves fast!

VCP stocks pagers, parts, refurbishing kits and batteries.
Terms: Net 30, C.O.D., company check or cash

*On in-stock items ordered by 12 noon CST

VCP COMMUNICATIONS DIVISION

P.O. Box 550999 • Dallas, TX 75355-0999
Toll-Free 1-800-527-9366 • Fax (214) 278-5981

Circle (75) on Fast Fact Card

BEETM Quality Leather Cases

We're working our hides for you!
Two-way / Cellular / Paging

We stock more quality top-grain leather cases than anyone else in the industry. Our manufacturing techniques match the advanced specifications of the latest in Portable Radio, Pager or Cellular models.

- Immediate delivery from large inventory.
- Two day delivery on set up orders.
- Logo imprinting. ■ Low pricing.

If you're not getting this kind of service ...call today.



Your one-call supplier
for Hard Protection
and Soft Leather Cases.

BEE Electronics, Inc.
2655 Gardner Road, Broadview, IL 60153
Toll Free: 800/336-3115 Fax: 800/345-2091

Circle (76) on Fast Fact Card

WirelessWorld Conference & Exhibition

SPONSORED BY

Cellular
BUSINESS

*November 2-4, 1993
Buena Vista Palace
Orlando*

Fax This Page to 312/922-1408 Attn: Tina Rubin

NAME

TITLE

COMPANY

DIVISION/DEPARTMENT

COMPANY ADDRESS

CITY/STATE/ZIP

OFFICE PHONE

FAX

☐ Please send conference information

☐ Please send exhibitor information

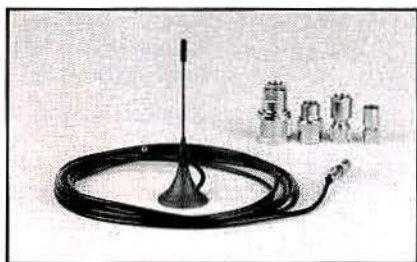
Or call Tina Rubin at 800/458-0479 or fax 312/922-1408

Cellular Business • 55 East Jackson Blvd. • Suite 1100 • Chicago, Illinois 60604

Circle (77) on Fast Fact Card

New products

Micro-magnetic antenna fits in compact places



The Allgon "Kiss" Micro Mag antenna measures 3.375 inches with a one-inch base diameter. It can be stored easily in a bag phone case, glove compartment or coat pocket. The quarterwave version is broadband with a frequency range of 806MHz-960MHz. A 3dB collinear version is also available from Allgon Mobile. A variety of screw-on connectors is available.

Circle (400) on Fast Fact Card

Mounts allow lockable tilt, ballbearing swivel

The SDI 7000/7001 MDT mounts are compact, low-profile devices that allow lockable tilt and ballbearing enhanced swivel for any mountable device. The SDI 7001 allows interface with the 5000HD product series.



Circle (401) on Fast Fact Card

Don't Get Caught With Your Lights Down!



The ProTekTor is designed to remotely monitor your tower lights to FAA and FCC requirements. The ProTekTor can monitor all types of tower lights including steady burning, flashing and photocell-controlled. Tower light controllers with built-in alarm outputs are interfaced directly, and those without alarm capability are easily monitored by installing current sensors in the power leads to the lights. The ProTekTor will alert you to all problems by immediately calling a pager, a computer, and/or a person (up to 4 different phone numbers can be called). The ProTekTor can provide a hard copy report to verify proper operation of itself and the telephone line.

The ProTekTor has additional inputs for monitoring other vital site conditions such as AC power, intrusion, temperature, etc., and its relay driver outputs can be used to automatically or manually control back-up (or other external) equipment. The ProTekTor also has an extensive Event History Log which provides a detailed time/date stamped record of all problems and actions taken on any equipment being monitored. Best of all, The ProTekTor is under \$1,000!

Our original products, the ProTek 24 and ProTek jr are larger and more advanced for those sites that require more extensive monitoring capability, as well as the ability to monitor RF power. For more information on our ProTek family of Monitor, Alert, and Control Systems, call us at:

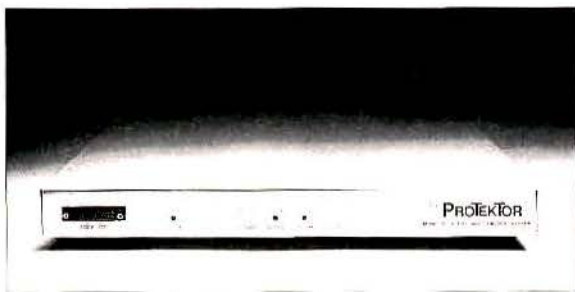
(919) 876-8294 or
FAX (919) 876-5666.

PAGETEK, INC

The Monitoring and Control Experts
2801 Spring Forest Road
Raleigh, NC 27604

Protect Your Tower with

The ProTekTor Monitor, Alert, and Control System



Circle (78) on Fast Fact Card

Adapter connects

Kenwood radios to test instruments

The RFB-1145 connects Kenwood radio models TK-230, TK-240, TK-330 and TK-340 directly to test instruments for service. For the radio user, the adapter allows immediate connection to the external mobile antenna, providing additional antenna gain and system range. The RFB-1145 from RF Industries is equivalent to the Kenwood part #E040-0236-25.

Circle (402) on Fast Fact Card

Distributor offers

Schlumberger service monitors

Tessco has become the wireless industry's exclusive supplier of Schlumberger communications service monitors, including the Stabilock 4031. Model 4031 incorporates 24 separate instruments into one self-contained service monitor. The monitor simplifies installation and testing of cellular base stations. Model 4015 puts "high tech" abilities in the reach of smaller shops with tighter budgets.

Circle (403) on Fast Fact Card

Mobile dispatch unit allows reprogramming from vehicle

The 7502 mobile dispatch unit is a compact (3" x 5" x 1.75") encoder, decoder and transponder that allows a dispatcher to control a mobile radio fleet. The unit from Zetron features standard DTMF signaling, compatibility with other radios and field-programmability. Dispatchers can call a selected vehicle, specific groups or the entire fleet quickly. To assure that the call was received, model 7502 in the vehicle transponds back to the dispatcher with an audible tone or ANI code. Reprogramming is possible without removing the unit from the vehicle by using the front-panel keys or DTMF commands.

Circle (404) on Fast Fact Card

RADIOCOMM 93

COMMUNICATIONS TECHNOLOGY— THE WIRELESS FUTURE

**RADIOCOMM
RETURNS
TO TORONTO**

MAY 26th

**T O
28th, 1993**

**METRO TORONTO
CONVENTION CENTRE
TORONTO, CANADA**

RADIOCOMM 93 is the opportunity
of the year for those whose business depends
on mobile communications.

It's the one place where you can gain new
and relevant information from industry
experts while seeing the latest
in wireless communications products,
systems and services.

**For Conference information call,
613-233-4888.**

**For Exhibitor and Attendance
information call, 416-252-7791.**

Sponsored by

RADIOCOMM
RadioComm Association of Canada



Managed and Produced by
INDUSTRIAL TRADE & CONSUMER SHOWS INC.

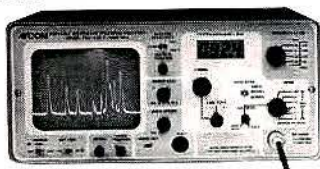
AVCOM's New PSA-65A Portable Spectrum Analyzer

The newest in the line of rugged spectrum analyzers from AVCOM offers amazing performance for only \$2,855.

AVCOM'S new PSA-65A is the first low cost general purpose portable spectrum analyzer that's loaded with features. It's small, accurate, battery operated, has a wide frequency coverage - a must for every technician's bench. Great for field use too.

The PSA-65A covers frequencies thru 1000 MHz in one sweep with a sensitivity greater than -95dBm at narrow spans. The PSA-65A is ideally suited for 2-way radio, cellular, cable, LAN, surveillance, educational, production and R&D work. Options include frequency extenders to enable the PSA-65A to be used at SATCOM and higher frequencies, audio demod for monitoring, log periodic antennas, 10KHz filter for .2 MHz/DIV range, carrying case (AVSAC), and more.

For more information, write, FAX or phone.



AVCOM BRINGING HIGH
TECHNOLOGY
DOWN TO EARTH

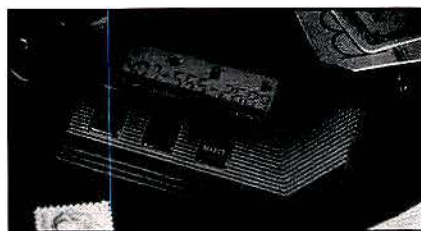
500 SOUTHLAKE BOULEVARD
RICHMOND, VIRGINIA 23236; 804-794-2500
FAX 804-794-8284

Circle (88) on Fast Fact Card

New products

Credit card-size pager boasts 12-digit numeric display

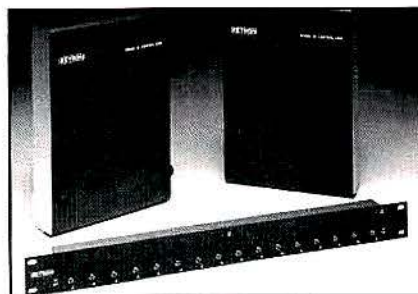
The Confidant numeric pager from Motorola is only 1/4-inch thick, 2 inches wide and 3 1/4 inches long—the size of a standard credit card. The unit has a 12-digit numeric backlit readout for displaying phone numbers. It can retain as many as eight messages in memory, even when turned off or while the batteries are being changed. The Confidant also can act as a watch with its time features and will time stamp each message. Unless in the silent mode, a musical alert indicates message



reception. Reminder chirps sound if the message is not acknowledged.

Circle (405) on Fast Fact Card

Control panel toggles remote equipment



The 1801 status and control panel is a switch panel that is used to toggle, as well as indicate, the status of remote equipment. Each of the 16 front-panel toggle switches can be connected to a motor, pump or other device to turn the device on or off. Each of the 16 LEDs can be connected to a flow, power or other sensor to indicate the status of the remotely located sensor. The unit from Zetron comes in a standard, 19-inch rack-mount casing.

Circle (406) on Fast Fact Card

Block Out Noise Beef Up Productivity

With an Earmark VOXSET II™

VOXSET II converts your ordinary two-way, portable radio into a voice operated communication system. Hands free operations raise productivity! Self-contained in a noise cancelling (23NRR)

muff, VOXSET II avoids the noise. Now with VOX130™, the self adjusting VOX. Simple, uses a 9V battery & single cable. Available with Boom Microphone, Throat Microphone, or NVM (no visible microphone). Rated Intrinsically safe by UL.



Call Earmark for a free demonstration.



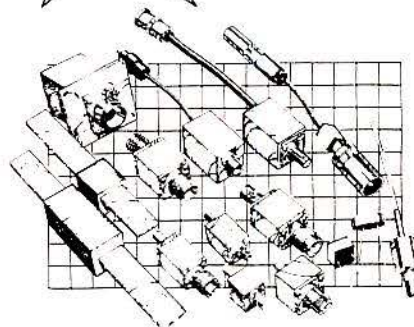
EARMARK®

1125 Dixwell Avenue, Hamden, CT 06514
Telephone (203) 777-2130
FAX (203) 777-2886

HSV2

Circle (89) on Fast Fact Card

... the smart source for Surge Suppressors and Limiters ...



SPIKEGUARDS

Announcing the expansion of our proven coaxial suppressors to include multi-pin and multi-coaxial configurations. All multi-circuit suppressors are engineered and packaged to your exacting system requirements and harsh environmental requirements.

Spikeguard, high speed transient suppressors protect sensitive electronic equipment from switching, lightning and EMP transients. Designs include protection of audio through 4 GHz circuits. Clamping voltages available upon request from 0.7 volts to 20,000 volts.

Many devices are now qualified to the demanding environmental requirements of MIL-STD-810, DO-160 and MIL-S-901C.



FISCHER CUSTOM COMMUNICATIONS, INC.

3121 West 139th Street, Unit F, Hawthorne, California 90250 (310) 644-0728 FAX (310) 644-2452

Circle (90) on Fast Fact Card

Controller operates four mobiles with one control head

The Multi-User Controller operates four Syn-Tech II mobiles from a single control head. The mobiles can be any mix of models and frequency bands as long as the microprocessor software matches. The controller from **Midland** consists of an interface box and small remote control head that gives the user push button selection and LED indication of the mobile under direct control.

Circle (407) on Fast Fact Card

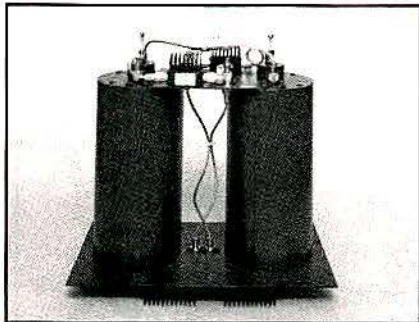
Container protects radio equipment from water

Two-way radio communications applications where the user and equipment might get wet or even submerged can be protected by TEA's Davies OSK-1, a soft plastic, belt-mounted container that accommodates most radio brands and types with the antennas attached. A waterproof zipper provides access for the radio and allows the user to adjust channel, volume and other radio controls easily. A main cable junction box breaks out separate cables for the headset and PTT switch.



Circle (408) on Fast Fact Card

Paging combiner covers 928MHz-960MHz range



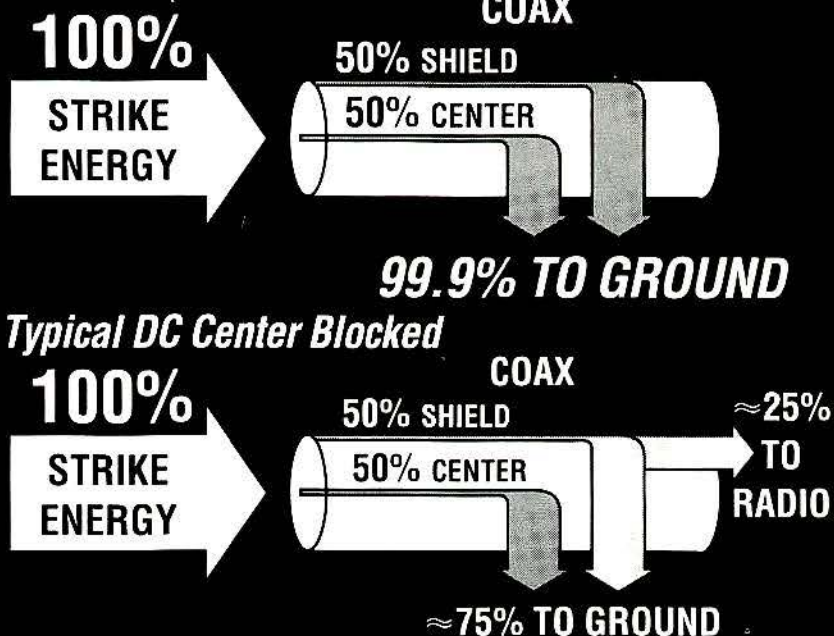
The SP9715 two-channel high-power paging combiner combines two transmitters as closely spaced as 500KHz, provides 50dB isolation and handles as much as 300W continuous input power per channel. VSWR at any port is 1.2:1, and return loss is 20dB minimum. The combiner from **Decibel Products** is for the 928MHz-960MHz frequency range.

Circle (409) on Fast Fact Card

NEW Isolating Protector Stops Lightning on Coax Line



New IE Series Protector COAX



Our patented Isolated Equipment (IE) Series Protectors ground and then **isolate** both the **shield** and the **center** conductor of your coax line. Lightning is diverted to the outside ground system. It can not travel to the equipment chassis and follow the electrical wires to ground which can happen with all other type protectors including 1/4 wave shorted stubs. The IE Series Protectors are available from 1.5MHz to 2.6GHz (to 20GHz Special). This innovative and unique series is **99.9% effective**, setting a whole new meaning to the term "Coax Protector". Of course it's from the World Leader in RF coax protection.

1500 models of coax, power and twisted pair protectors . . . plus lightning/EMP and grounding solutions.

PolyPhaser
CORPORATION

(800) 325-7170
(702) 782-2511
FAX: (702) 782-4476

2225 Park Place ■ P.O. Box 9000 ■ Minden, NV 89423-9000

Circle (91) on Fast Fact Card

WACOM

LOW LOSS TRANSMITTER COMBINERS RECEIVER MULTICOUPLERS

150-450-800 MHz

DUPLEXERS and CAVITY FILTERS, including our patented B₀ B₁ CIRCUIT[®] FILTERS, for all bands within the frequency range of 30 to 960 MHz. Investigate this complete line of high performance products.

CALL
817/848-4435



WACOM
PRODUCTS, INC.

P.O. BOX 21145
WACO, TEXAS 76702 • 817/848-4435



Circle (92) on Fast Fact Card

New products

Expansion package allows gradual growth for paging terminal

The GL3000EX expansion package from Glenayre allows owners to gradually expand their systems. The expansion shelf is identical to the GL3000ES except for the blackplane and rear door. As many as three of the expansion shelves may be added below the GL3000ES. The first expansion shelf allows growth to 10 universal slots, 14 voice storage boards (VSBs), and 4 x 120 Mbyte disk drives. The second expansion shelf allows growth to 16 universal slots, 24 VSBs and 6 x 120 Mbyte disk drives. The third expansion shelf will allow growth to 22 universal slots, 34 VSBs, 6 x 120 Mbyte disk drives and 50,000 subscribers.



Circle (410) on Fast Fact Card

EXCEPTIONAL WIRELESS TELEPHONE PRODUCTS

DataCom's PhoneLink/DataLink

DataCom
Systems, Inc.



IDEAL FOR:

- Remote locations and sites
- Emergency communications
- Permanent or temporary services
- Mobile Phone communications
- Standard Range 450-470 MHz

OTHER PRODUCTS:

- 2WFD Phone Link \$3495⁰⁰
- 4WFD Data Link \$3495⁰⁰
- Above Units With Diagnostic Display \$4495⁰⁰
- RF Network SCADA, call for pricing

217-222-0160
217-222-0912 (FAX)

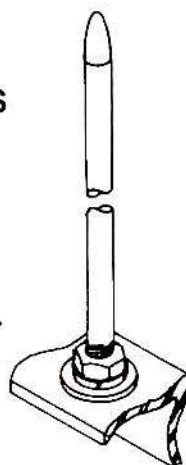
DataCom, Inc.
524 N. 30th St.
Quincy, IL 62301

Circle (93) on Fast Fact Card

SPECIALISTS IN: LIGHTNING PROTECTION SURGE SUPPRESSION GROUNDING

FEATURING:

- TOWER LIGHTNING RODS
- GROUND BARS
- CADWELD[®]
- GROUNDING EQUIPMENT



HARGER
LIGHTNING PROTECTION, INC.

1066 CAMPUS DRIVE, MUNDELEIN, IL 60060
(708) 362-4848 • (800) 842-7437 • (708) 362-3519

Circle (94) on Fast Fact Card

Mobiles offer full-duplex capabilities



The Syn-Tech II two-way mobile radios offer full-duplex capability, programmable CTCSS/DCS encode and decode with carrier-operated relay and provision for a bottom-mounted internal duplexer. The mobiles from Midland are programmable for as many as 320 channels in 16 groups. VHF frequency range is 136MHz-160MHz or 150MHz-174MHz; RF power is adjustable from 20W-40W. The UHF frequency range is 406MHz-430MHz or 450MHz-470MHz; RF output is 15W-30W. The radios are available in field-convertible under-dash and remote-mount configurations with a choice of control, head, control panel layout and either standard red LED or deluxe alphanumeric LCD displays.


Circle (411) on Fast Fact Card

Compact status reporter features DTMF, nine status indicators

Model 1012C DTMF status reporter from Pyramid Communications features nine status indications, auto acknowledge and retry, auto-interrogate, selective and group call, horn honk, ANI on PTT and over-the-air console assignment. The unit measures 5 1/4" x 4 1/4" x 1 1/4" and is front-panel programmable. Other features include a built-in test mode and a sealed membrane keypad.



Circle (412) on Fast Fact Card



NUMERIC

uniden

- VHF, UHF, 900 MHz
- POCSAG signalling format
- Holds up to 16 messages
- 128 Character memory
- Selective message delete
- Uses one "AA" alkaline battery

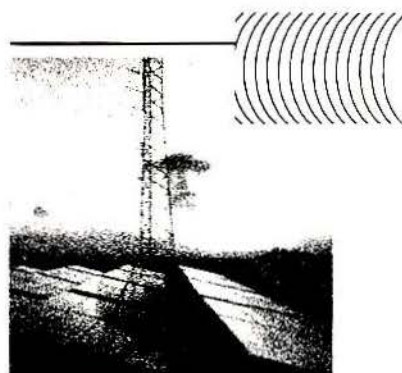
VCP INTERNATIONAL, INC. DALLAS, TEXAS

COMMUNICATIONS DIVISION

P.O. Box 550999 Dallas, TX 75355-0999 Wats 800-527-9366 FAX # (214) 278-5981

Circle (87) on Fast Fact Card

SIEMENS



The Power to Communicate Anywhere

Solar electric power: proven reliable on mountain tops around the world. Complete integrated systems. Modules are UL listed, 10 yr. warranty.

Solar Electric Specialties

P.O. Box 537, Willits CA 95490
800 344-2003



Siemens Solar Industries

Circle (80) on Fast Fact Card

Call For Your Copy Today!

New for Winter 1993

ANTENEX








WHOLESALE CATALOG AND PRICE LIST

ANTENEX SIGNAL PROPAGATION SYSTEMS
2000-200 Bloomingdale Road • Glendale, IL 60139 U.S.A.
TOLL FREE (800) 323-3757 • Fax (800) 851-9009

Circle (81) on Fast Fact Card



G7-150 Series 148-174 MHz Omnidirectional Fixed Station

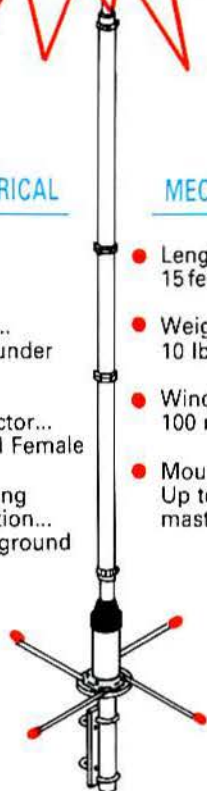


ELECTRICAL

- Gain... 7dBd
- VSWR... 3MHz under 1.5:1
- Connector... Type N Female
- Lightning Protection... Direct ground

MECHANICAL

- Length... 15 feet 4 inches
- Weight... 10 lbs.
- Wind Survival... 100 mph
- Mounting... Up to 2 inch mast



CALL NOW
800-949-9490

IN TEXAS CALL COLLECT (817) 325-1386

HUSTLER, INC.
One Newtronics Place
Mineral Wells, Texas 76067

Circle (82) on Fast Fact Card

New products

Paging interface reduces keyboard entry

The alarm paging interface (API) allows inexpensive digital dialers to automatically send text messages to alphanumeric pagers. The API from **Telemessaging Devices** simplifies the alphanumeric paging process

by eliminating or reducing the need for keyboard entry devices and operators by automatically sending critical text messages.

Circle (413) on Fast Fact Card

Software aids in radio tuning

The Radio Spectrum Explorer for Windows by **Advanced Computer Controls** is a user interface for the VHF and UHF communications receiver. The program enables the user to explore the radio spectrum, tuning the radio in terms of what the user wants to hear, rather than frequency, making it easy to discover and monitor the wide range of signals present in the area.

Circle (414) on Fast Fact Card

Paging antennas offer

9dBd, 10dBd gain

The DB809K-YP and DB810K-YP 928MHz-932MHz paging antennas offer 9dBd or 10dBd gain. The rugged antennas resist winds to 150mph and 0.5 inch of icing. The **Decibel** antennas use the company's center-fed transposed tube design to provide a VSWR of 1.2 to 1 or better.

Circle (415) on Fast Fact Card

Enhanced Beacon Power Converter Increased Capabilities - Decreased Size

Once again, we've responded to your medium intensity strobe lighting requests! You asked for a *smaller, lighter power converter* with dual-system interface capabilities. Now, in the FTB 310 it's yours! We just couldn't quit - we went a step further to include automatic restart upon red beacon failure.

Get *unparalleled* performance and savings for strobe or dual. Compare! Ask for fact-packed FTB 310 brochure. Call (615) 377-0600 or fax 800-4-A-FLASH. Flash Technology, P.O. Box 329, Nashua, NH 03061



Circle (86) on Fast Fact Card

See us at IMCE Booth #1361

ISOLATORS - CIRCULATORS - LOADS



EMR Corporation has been manufacturing quality R.F. filtering products and providing antenna site consulting services since 1980.

Our products are high performance and our approach to antenna site engineering is practical and economical.

Contact EMR for technical assistance and product information. We will send you our catalog and a free copy of "TECHNICAL PAPERS".... a collection of articles on isolators, duplexers, TX combiners and RX multicouplers.

22402 N. 19th Avenue
Phoenix, Arizona 85027
TEL: 602-581-2875
FAX: 602-582-9499

CAVITIES - ANTENNA DUPLEXERS

Circle (83) on Fast Fact Card

Adapter suits 600, 800 or 900 series Oki cellular telephone

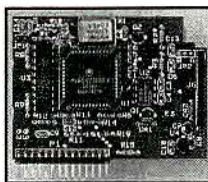
The E²-250 test interface adapter from E² is designed to facilitate automated testing of Oki cellular telephones. The product provides access to Oki's proprietary synchronous interface through a standard RS-232-C serial interface port. The E²-250 can be used with a PC, serial data terminal or suitable communications test set to communicate with any 600, 800 or 900 series Oki cellular telephone.

Circle (416) on Fast Fact Card

Module converts radios into trunking radiotelephones

The RTX 7510 mobile control module from Radio Telephone Exchange converts conventional Maxon two-way mobile radios into an RTX trunking radiotelephone system. The RTX 7510-enabled Maxon mobile connects with a RTX 6000 repeater controller, which serves as the wireless link to the central office and between the various extensions. Features include broad system flexibility, including mobile-to-telephone, telephone-to-mobile and mobile-to-mobile operation for individual and group calling, and telephone-to-pager and mobile-to-pager service for as many as 1,000 mobile telephone users and 1,000 pagers.

Circle (418) on Fast Fact Card



Lightweight shelters travel on collapsible trailer

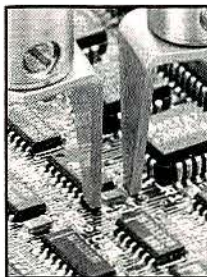
Lightweight aluminum communications equipment shelters may be transported by land during emergencies and after natural disasters more easily and quickly than other shelter types. Made by Mobile International, the Containervan is built to be transported by land on a specially designed collapsible trailer. The shelters are available in 20-foot and 40-foot models.

Circle (417) on Fast Fact Card

Handpiece offers 'hot-bar,' connector removal tips

The TT-65 ThermoTweez handpiece from Pace has "hot-bar" tips for removing various surface mount components. The tips' contact lengths range from 0.03" to 2.0". The "hot-bar" tips provide direct-contact thermal transfer to all of the solder joints on various two-sided surface mount components, including chip components, SOTs, SOICs, SOJs, SIMMs and connectors. The tweezing action of the handpiece allows for easy, one-handed removal from the circuit board.

Circle (419) on Fast Fact Card



G6-450 Series 450-470 MHz Omnidirectional Fixed Station

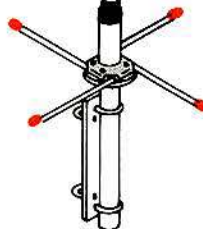


ELECTRICAL

- Gain... 6dBd
- VSWR... 8MHz under 1.5:1
- Connector... Type N Female
- Lightning Protection... Direct ground

MECHANICAL

- Length... 87 inches
- Weight... 16 lbs.
- Wind Survival... 125 mph
- Mounting... Up to 2 inch mast



CALL NOW
800-949-9490

IN TEXAS CALL COLLECT (817) 325-1386

HUSTLER, INC.
One Newtronics Place
Mineral Wells, Texas 76067

Circle (85) on Fast Fact Card

WOULD YOU BELIEVE

a BETTER MIC for LESS MONEY



Setting A New Standard For Reliability And Longevity

All models feature optical PTT switches for extreme reliability. Our back-lighted keyboards use individually sealed snap dome switches from ITT for reliability and serviceability. Levels are externally adjustable.

TTM-9000 - Manual dialing with automatic PTT.

TTM-9100 - Manual dialing with PTT timer, PTT control of the hang-up function (no need for a grounded hang-up clip), and continuous or burst mode dialing.

TTM-9200 - Memory dialing, dual ANI, store and send, and scratch pad memory. All memory dialing is done using only a single button.

TRULY A NEW GENERATION OF DTMF MICS **BELIEVE IT**

**INTERCONNECT
SPECIALISTS INC.**

474 CHARLOTTE STREET
LONGWOOD, FL 32750
TOLL FREE 800-633-3750

Circle (84) on Fast Fact Card

Cp-ter™ The Symbol of Authority



Synthesized Hand
Portable Two-way
Radio



Quasi-trunked
Radio Telephone

Recognized for centuries as the "symbol of authority" and leadership, the scepter stands out. Cp-ter™ and Cp-ter-QTX™ by Monark® revive the tradition. Hand Portable Radios and Radio Telephones that bring back pride in ownership with features and style ranking with the noble but a price that will make your royal treasurer smile.

Cp-ter™ synthesized micro-processor conventional radio designs have an abundance of the most popular features like Scan, Priority, ANI, CTCSS, DTMFF encoding and decoding, and much more.

Cp-ter-QTX™ Radio Telephones provide exclusive built in multi-format programming for compatibility with a wide range of DTMF store and forward controllers without the need for any trunking option board. It's all in the software.

Dealers are being selected presently so please call or write us for additional information and for the REP. in your area.

Visit us at IMCE, Anaheim, Booths 1265, 1267.

Monark International Corp.®
10735 N.W. Ambassador Dr.
Kansas City, Missouri 64153
Tel: 816-891-0700
Fax: 816-891-0888

© Copyright 1993

Circle (104) on Fast Fact Card

CUSTOMIZED Transportable Base Stations and Repeaters

- Heavy Duty Polycarbonate O-Ring Sealed Cases
- Anodized Aircraft Aluminum Control Panel
- VHF ● UHF ● Duplexed ● Crossband
- Battery Back-Up
- AC Power Supply/Charger
- Voice Recorder
- Voice Encryption ● ANI

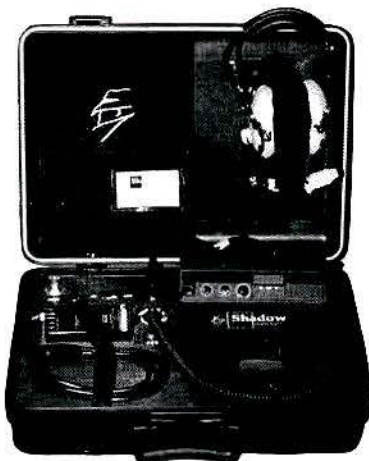


Shadow

Technologies Group, L.C.

2325 Ponderosa Drive, Lawrence, KS 66046

PH (913)749-3566 ● FAX (913)749-1036



BUILDING YOUR IMAGINATION

Circle (105) on Fast Fact Card

Literature

Brochure illustrates fume extraction systems

The Arm-Evac fume extraction brochure covers a variety of fume extraction systems to remove hazardous fumes from solder operations and other electronic assembly processes. The brochure from Pace explains the benefits of local exhaust by removing harmful particulates and gases before they reach the worker's breathing zone.

Circle (351) on Fast Fact Card

Application note covers VSWR measurement

A 6-page application note titled "Compensate Coaxial Cable Effects When Measuring VSWR" is available from Direct Conversion Technique. It describes how the transmission line affects the measurement of VSWR in all antenna systems and how the test engineer may improve antenna measurement accuracy by compensating for these cable effects.

Circle (352) on Fast Fact Card

Brochure lists tone signaling products

The 40th anniversary brochure from Bramco lists products for tone signaling and remote control. Products include automatic number identification (ANI), DTMF tone signaling, remote control, tone sequential, reeds and filters for Motorola pagers.

Circle (353) on Fast Fact Card

Catalog features base station antennas

More than 1,000 items are featured in Cartwright Communications' base station antenna and cable catalog. The catalog contains technical specifications defining electrical and mechanical characteristics of each product and includes hundreds of charts, graphs and photos. Antennas are grouped by frequency; cables are grouped by size.

Circle (354) on Fast Fact Card

Brochure shows submersible headsets

Literature from Television Equipment Associates describes its range of submersible headsets and radio containers for waterproof communications. Police, firemen and special forces report success when using radios near, on or under water.

Circle (355) on Fast Fact Card

Public safety communications

Readers were asked in the September 1992 "What Do You Think?" questionnaire about public safety communications, product features, challenges and trends. The following charts indicate features readers look for in communications products (multiple responses add up to more than 100%):

Communications consoles features

Easy to use	73.3%
Crosspatch capability	56.7%
Surge protection	53.3%
User programmable	50.0%
Mic with PTT	43.3%
Multiformat paging/signaling capability	43.3%
12/24-hour clock	36.7%
Ergonomic design	30.0%
Hands-free operation	30.0%
Other	20.0%

Headsets features

Lightweight	86.7%
Movable boom mic	60.0%
Single-ear muff	43.3%
Adjustable Vox delay/mic sensitivity levels	36.7%
Built-in Vox	36.7%
Ear mic	33.3%
Vox override with locking PTT	26.7%
Double-ear muff	23.3%
Throat mic	6.7%
Other	13.3%

Cases features

Belt loop with swivel mount	70.0%
Leather material	50.0%
Keypad access hole	30.0%
Soft vinyl material	26.7%
Shoulder strap	16.7%
Other	16.7%

Logging recorders features

Date/time stamping	66.7%
Auto search capability	63.3%
Fail safe system	56.7%
Instant data retrieval	53.3%
Digital storage drives	40.0%
Internal power supply	40.0%
High security	30.0%
Other	16.7%

Challenges faced by readers in public safety communications include:

- "Access to dependable communications equipment."
- "Direct communications access to other jurisdictions."
- "Ease of operations, security, flexibility."
- "Inter-agency coordination."
- "Meet increased demand for radio communications with limited frequency spectrum."

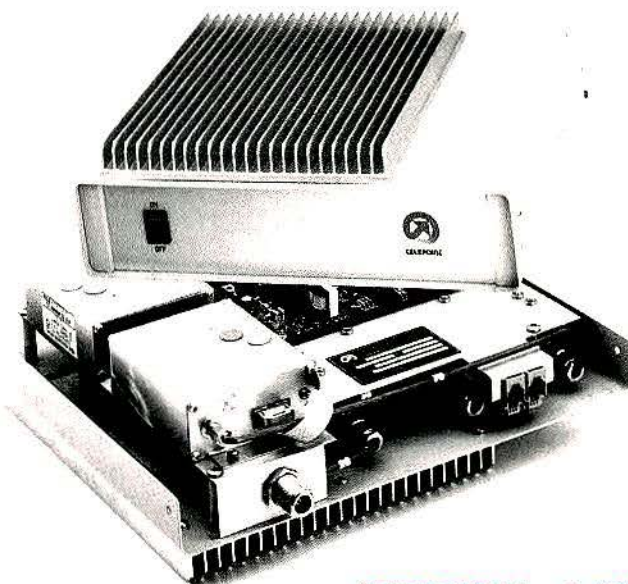
Design trends in transceivers that readers would like to see in public safety applications include:

- "AVL on portables. Trunked alphanumeric tone and voice pager."
- "Easy-to-read alphanumeric displays."
- "Long battery life and ease of use."
- "Smaller size, more wattage and more rugged."



AT LAST... DIGITALLY-CONTROLLED RADIO TELEPHONE SYSTEMS

**TRANSMIT VOICE, FAX AND DATA FOR AN
INCREDIBLY LOW COST WITH TELEPOINT'S FULL
DUPLEX PRIVATE RADIO TELEPHONE LINKS.**

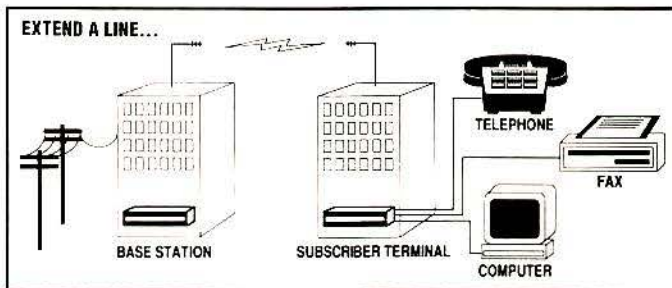


SUPERCOM booth #811

The Unitel RTL-1000 is the most advanced radio telephone link ever developed...giving you all these benefits, and more:

- Digital control for absolute reliability
- Exceptional audio quality-produced by a compander
- Full duplex selective intercom
- 900/800 Mhz/UHF & VHF bands
- 2 to 100 watts RF output
- Currently in operation worldwide

At Telepoint, we deliver quality, performance and reliability...with the radio telephone systems of the future!



CALL NOW

**FOR MORE INFORMATION ON TELEPOINT'S ENTIRE LINE OF TELEPHONE LINE
EXTENDERS...AND YOUR FREE SYSTEMS PLANNING GUIDE.**

TELEPOINT INC.

1022 South La Cienega Blvd., Los Angeles, CA 90035

Toll Free: **(800) 333-6444**

Phone: **(310) 652-3666** Fax: **(310) 652-0777**

Circle (95) on Fast Fact Card

Better Than A Zetron 38

We're complimented that our competition keeps making wild claims that their repeater panels are superior to ours. It's absolutely great to be the standard that all other products try to imitate or surpass.

But Zetron is the only one that can truthfully claim to have a product better than the legendary Model 38 Repeater Tone Panel.

Introducing the Zetron 38-MAX

We took all we learned from the benchmark 38 (and a hard look at all the others), and enhanced the 38 so we can offer you the best combination of price performance and features.

- 160 user capacity (the MAX)
- 50 CTCSS user groups
- 110 DCS user groups
- ToneLock ^(TM) sensitivity better than 3dB SINAD
- Proper operation with squelch tail elimination
- Airtime accumulation, pre-pay airtime per user
- RS-232 AND remote DTMF programming
- Site alarm and optional auxiliary relay
- Low power operation

So, if you're serious about how well your community repeater operates, and if you want to avoid all those nagging doubts . . .

**. . . just call Zetron and
ask for "The MAX".**

We'll shoot holes in all Z-competitor's claims. The MAX is all the repeater panel you'll ever need at a price that can't be beat - and you can take that to Z-bank.

ZETRON

12335 134th Ct. N.E. Redmond WA 98052
Phone: (206) 820-6363 Fax: (206) 820-7031

Circle (96) on Fast Fact Card

People

Changes at Glenayre Electronics, Charlotte, NC:

Dave Hetzler, director of Quincy Support Operations, moves up to vice president of Glenayre Care, the company's customer service division.

Ken Thompson, vice president of marketing, advances to vice president of worldwide marketing.

Steve Hannah, director of RF product management, moves up to director of U.S. technical support services.

Steve Lubahn, director of international RF product marketing, advances to manager of RF product management.

Changes at Glenayre Electronics, Vancouver, British Columbia:

Don Gayton, director of systems development, advances to vice president of engineering.

Rob Marchetto, a member of the digital signal processing group, moves up to director of advanced development.

Kurt Zoeller exits as manager of distributor sales for Fujitsu Imaging Systems of America in Danbury, CT, to join Glenayre Electronics as regional sales manager in Danbury.

Joe Vaughan departs Johnson Radio Communications, Minneapolis, as a sales and marketing representative to join Telex as its domestic sales manager for land mobile radio products.

Mark Louison departs NYNEX Mobile Communications, New York, as vice president and general manager to join AccessLine Technologies, Bellevue, WA, as senior vice president of operations.



Save your RSA license with solar electricity...

When you need power far and away from the grid, solar electricity is the most reliable and cost-effective power source you can choose. Reliable power for:

- Cellular Repeaters
- Two-way Repeaters
- Microwave
- Remote Fixed Cellular
- Data Acquisition

At Photocomm, we offer the best power module on the market - the Kyocera polycrystalline module with a worldwide reputation for quality and performance and an unprecedented 12-year warranty. For your toughest applications, specify our DuravoltTM module, featuring Kyocera solar cells and our exclusive Tetzel[®] glazing - it's virtually unbreakable. We also offer a staff of experienced solar application engineers to help you solve your specific needs. For reliable power, no matter how remote, call us today.



Photocomm, Inc.
7681 East Gray Road, Scottsdale, Arizona 85260
Telephone: 602-948-8003 FAX: 602-483-6431

Photocomm is an authorized distributor of the complete line of Kyocera Solar Power Modules

KYOCERA

Circle (97) on Fast Fact Card

L etters to the editor

Trunking systems:

After reading Rand Ellis' December 1992 letter concerning trunking system dangers, I felt that some potential trunking system user-agencies may forgo the advantages of trunking for fear of the dangers expressed.

The issue the letter expresses is true. Nonetheless, complex communications systems such as public safety trunking systems cannot be managed as the simpler conventional systems have been managed in the past. The issue the letter raises is one of management, not equipment or systems.

The public safety trunking concept is centralized command, control and management, whereas conventional systems rely upon user control and management. The letter correctly states: "On a conventional radio channel, you (*the user*) know who is on the channel and how busy it is on a daily basis."

On public safety trunked systems, astute managers know exactly who is using which *talk group* and when, and exactly how much airtime each user and group of users consumes. In addition, exact statistics are provided on all use, including the exact

extent of blockage and delay times and busy-hour resource use.

An astute manager, armed with these statistics, can be much more effective than a user who only has a *perception* of channel congestion. This well-versed manager certainly will have more influence upon the *powers of purchasing* and the budgeting process than the daily user.

The letter further reads that a heavily loaded system cannot survive (operationally) a large-scale emergency. This statement may be true if the system is not adequately managed.

As the editor's note indicates, prior articles written by Dr. Gregory M. Stone and David N. Gelyana introduced this problem and provided the planning and management concepts necessary to ensure that a trunking system survives large-scale emergencies. Conventional systems, totally lacking centralized command and control over the users, do not survive large-scale emergencies as well as fine-tuned, well-managed trunked systems.

The letter's concluding statement that "... a trunking system does not generate user complaints that previously have helped to justify system expansion" is true.

BATTERY PROBLEMS??

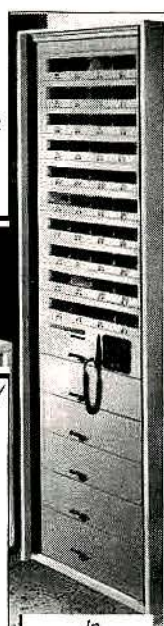
Our customers agree that the RAMSystem is the most effective ANALYZER on the market!



BATTERY PRO

Call before you invest ...

**BatteryPRO
Centres Inc.
P.O. Box 160
Black Diamond,
AB Canada
T0L 0H0**



In
North America
call
1-800-661-9401
or Fax
(403) 933-3233

Circle (99) on Fast Fact Card

Radio Direction Finders?

We have exactly what you need!

with 16 models to choose from to solve just about any kind of DF problem anywhere it might occur.

Handheld	1.6 to 1000 MHz
Mobile	300 kHz to 1000 MHz
Fixed Site	100 kHz to 1000 MHz
Marine	200 kHz to 18 Mhz and 100 to 500 MHz

and we can supply the options you need most

- **Remote Control**
- **Data Logging Recorder**
- **On-Screen Map with triangulation and zoom**

Call us today, toll-free, for complete information on our sophisticated solutions to your everyday DF problems.

SIMRAD
19210 33rd Avenue West
Lynnwood, WA 98036
Telephone: (206) 778-8821
Toll-free: (800) 426-5565
Telefax: (206) 771-7211



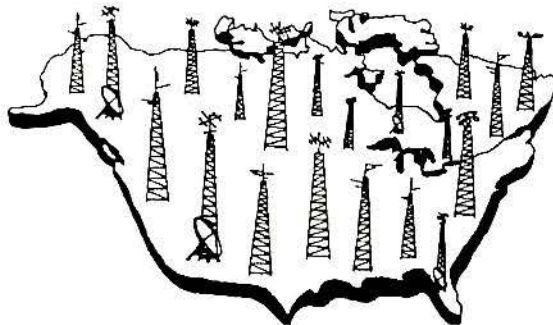
SIMRAD

Circle (98) on Fast Fact Card

TITANTM

O W E R S

are sprouting up
all over North America



Available up to 96', TITAN self-support towers offer an unbeatable combination of quality and versatility at a price that makes them an outstanding value.



TRYLON
MANUFACTURING CO. LTD.

P.O. BOX 186, 21 HOWARD AVE. ELMIRA, ONT. CANADA N3B 2Z6
TEL (519) 669-5421 FAX (519) 669-8912

Circle (100) on Fast Fact Card

Central to:

- Customer Needs
- Engineering
- Quality
- Fabrication
- Installation
- Specialized Services



CENTRAL TOWER INC.

Central to All Your Tower Needs

2855 Hwy. 261 • Newburgh, IN 47630-8612
800-264-0595 • FAX 812-853-6652

Circle (101) on Fast Fact Card

Letters to the editor

By contrast, trunking systems provide the detailed data necessary to inform the system administration of its load condition while allowing the users to operate efficiently, unaffected by potential system problems. In that manner, user complaints and problems can be averted.

Whenever a public safety agency decides to change from conventional to trunked technology, it must change the way it manages and administers its technology. Otherwise, the agency will succumb to the dangers expressed in the December letter.

Unfortunately, the dangers the letter expresses are experienced by many who use trunked technology, but this does not have to be the case. Trunked system vendors do an excellent job of providing new technology. Publications such as *MRT* are among the few sources of information about how to plan and use that technology effectively.

George W. Weimer, P.E.
Vice President of Engineering
Raymond C. Trott
Consulting Engineers
Irving, TX

Management:

From time to time, I have thought about the July 1991 letter you printed about *management*.

During the last six years or so, I have found myself in an even worse situation than the writer of the July 1991 letter describes. That probably is why I have kept the letter in mind all this time.

The maintenance field has degraded considerably in the last few years. Rather than a company promoting experienced technicians to middle management positions, inexperienced college persons are put into positions of responsibility.

They have no comprehension of the problems involved in troubleshooting, analyzing and repairing a piece of complex electronic equipment. They are of the opinion that a technician has no need of electronics knowledge and has no business taking time to learn even the basics of his assigned equipment, such as block diagram flow or the basic operating concept of the equipment.

Management's attitude is that they are not to be questioned; their judgment in these matters is absolute, and it is heresy to question decisions they make. Therefore, their response usually is either silence



**Record every word
automatically...
be able to prove who
said what and when.**

Today's legal environment requires precise documentation. Use Omnicron Voice Logging Recorders to record your important telephone and two-way radio conversations. They provide immediate review plus a tape to store for future reference... the sensible way... at a sensible price.

SAVE A LIFE..... SAVE YOUR BUSINESS



- ☒ Easy Installation
- ☒ Automatic voice activation
- ☒ 2, 8, or 16 hours of solid talk time on each standard audio cassette tape
- ☒ Fail safe - alarms monitor tape movement to prevent errors
- ☒ Talking Time Clock repeats the time and date on optional time track
- ☒ Full line of accessories - transcribers, tapes, sequencers, phone couplers, radio cables, etc.
- ☒ Immediate delivery
- ☒ Service



**OMNICRON
ELECTRONICS**

581 LIBERTY HIGHWAY
P.O. BOX 623
PUTNAM, CT 06260-0623
TEL: 203-928-0377
FAX: 203-928-6477

Circle (102) on Fast Fact Card

Tone & Voice Monitor Pagers

Available in VHF-LO, VHF-HI, and UHF. . .
compatible with other existing
two-tone systems.



**Pager Repair
\$19.95** plus parts

NEC • GE • MOTOROLA • SHINWA
Tone & Voice Pagers



Call or fax
TOLL FREE for
information

INTERNATIONAL CRYSTAL MFG. CO., INC.

P.O. Box 26330 • 729 W. Sheridan • Oklahoma City, OK 73126-0330 • (405) 236-3741
FAX (405) 235-1904 • Toll Free Phone 1-800 725-1426 • 24 Hour Toll Free Fax 1-800 322-9426

Circle (103) on Fast Fact Card

Mobile Radio Technology

The journal of mobile communications technology

BUSINESS

Cameron Bishop, *Group Vice President*
 Mercy Contreras, *Publisher*
 Darren Sextro, *Marketing Director*
 Kathryn Buckley, *Promotions Manager*
 Sally Nickoley, *Promotions Coordinator*
 Dee Unger, *Advertising Business Manager*
 Mary Birnbaum, *Advertising Production Supervisor*
 Liz Turner, *Advertising Coordinator*
 Tammy Kalebaugh, *Classified Advertising Coordinator*
 Tom Cook, *Group Senior Managing Editor*
 Doug Coonrod, *Corporate Art Director*
 Becky Anderson, *Group Director of Special Projects*

R.J. Hancock, *President*
 Sandra Milan, *Corporate Circulation Director*
 Michele Bartlett, *Circulation Director*
 Larry Gorsuch, *Circulation Coordinator*
 Customer Service, 913-967-1711

ADVERTISING SALES OFFICES:

ENGLEWOOD, COLORADO
 Ruth Breashears, *Northeast region (CT, Eastern Canada, MA, MD, NH, NJ, NY, OH, PA)*
 Carla M. Gamino, *Southeast region (AL, AR, FL, GA, MO, MS, NC, OK, SC, TN, VA)*
 Diane Hite, *Midwest/Southwest region (AZ, CO, KS, LA, MT, NE, NM, NV, TX, UT, WY)*
 Mercy Contreras, *Publisher*
 333 W. Hampden Ave., Suite 803
 Englewood, CO 80110
 Phone: 303-762-1249
 Fax: 303-762-0069

SAN RAFAEL, CALIFORNIA
 Dennis Hegg, *West region (AK, CA, OR, WA, Western Canada)*
 950 N. Gate Drive, Suite 207
 San Rafael, CA 94903
 Phone: 415-491-1442
 Fax: 415-491-1842

CHICAGO
 Janet Blaney, *East Central region (IA, IL, IN, MI, MN, WI)*
 55 E. Jackson, Suite 1100
 Chicago, IL 60604
 Phone: 312-435-2340
 Fax: 312-922-1408

OXFORD, ENGLAND
 Richard Woolley
 Unit 3, Castle Farm Business Centre, Clifton Road
 Deddington, Oxford, OX15 4TP, United Kingdom
 Phone: +44 (0)869 38794
 Fax: +44 (0)869 38040

CLASSIFIEDS

Jennifer Hinkle
 9800 Metcalf Ave.
 Overland Park, KS 66212-2215
 Phone: 913-967-1927
 Fax: 913-967-1901

LIST RENTAL SERVICES REPRESENTATIVE

Greg Hembree
 9800 Metcalf Ave.
 Overland Park, KS 66212-2215
 Phone: 913-967-1872
 Fax: 913-967-1897

Letters to the editor

or derisive language whenever the subject of correcting their misconceptions is broached.

Diplomacy is seen as weakness, and all efforts are made to squelch communication on the subject.

No matter how much a person makes, his self respect, personal dignity and self-perceived worth are not for sale. Although it is unreasonable to flit from job to job in today's environment, it is obvious that

companies with the attitude described above only are reaping the disgust, anger and eventually disloyalty justly due them because of their arrogance and lack of faith in their employees.

I would be interested in hearing comments on this subject from other readers. Others' views, positive or negative, would be helpful in assessing my own thoughts.

Name withheld



The ULTIMATE PROTECTION...

NOBODY...but NOBODY beats the quality and workmanship of **LEATHERSMITH's** cases for two-way radio equipment.

LEATHERSMITH's specially-developed, steer hide leather cases are expertly designed by Pennsylvania craftsmen.

LEATHERSMITH's cases feature durable, rust-proof nickel-plated snaps and fasteners. Quick disconnect swivels are optional on all models in polished steel and sturdy molded nylon.

Your choice of covers is included in our low, low prices.

"Delivered on time ALL the time!"

Call TODAY for your FREE information pack

Toll-Free 1-800-233-0440 Fax 717-933-5653



LEATHERSMITH

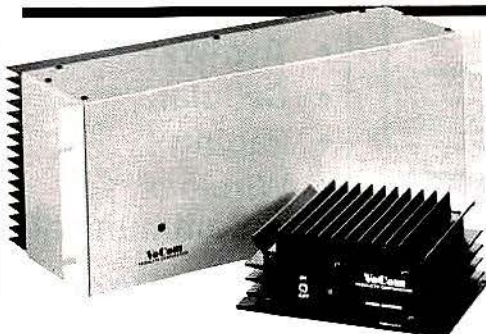
Rich, full-grained leather cases for the latest models In stock now!



417 Frystown Rd.
 Myerstown, PA 17067

Circle (106) on Fast Fact Card

BIG or SMALL We Have It All!



POWER AMPLIFIERS FOR ALL INPUT LEVELS

- VHF Low Band to 300 watts
- VHF High Band (140-200 MHz) to 500 watts
- UHF Low Band (400-550MHz) to 350 watts
- UHF High Band (800-960MHz) to 140 watts
- True continuous rating at high ambient temperatures
- FCC type accepted

VoCom / RF Corporation

Quality since 1979

1-800-USA-MADE

(1-800-872-6233)

FAX 708/924-9078

Circle (107) on Fast Fact Card

GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- \$37.00 hr./2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID



Smith Communications Service
2121 Parrish Ave., Owensboro, KY 42301
502-683-0936



LIGHTNING PREVENTION SYSTEMS

STATIC DISSIPATION AND
GROUNDING SYSTEMS
FOR COMMUNICATIONS TOWER SITES
204B Cross Keys Road, Berlin, NJ 08009
FAX 609-767-7547 • (609) 767-7209
Don't Wait Until It's Too Late!



(301) 925-9400
(800) 787-2732
Fax (301) 925-8612

Telecommunication & Information Science Division

Public Safety, Transit, Government & Industry

CORPORATE OFFICE
Donald P. Nowak 1401 McCormick Drive
Manager Landover, Maryland 20785

BDK Engineering

Consulting/Contracting Engineers, Real Estate Acq., Arch. Design, FCC/FAA issues, Antenna Installation, Site Surveys, RF Drive & Noise tests, Propagation studies, Preinstall Coverage tests.

AVL, NAMPs, CDMA, TDMA, PCS/N, SMR

Complete Project Management: Marketing/Engineering Concept & Design, Network Installation, Implementation & Optimization

Chicago, Illinois Telephone (708) 259-4508

Communications Technology Associates

A division of Hayes, Seay, Mattern & Mattern, Inc.

PLANNING AND DESIGN:

- 2-Way Radio
- MW & F/O
- CAD/MDT/AVL/Paging

PLUS:

- Complete A&E Services
- Bldgs, Towers, Pwr Sys
- Structural Engineering



Bus (834) 239-9225
FAX (834) 239-9221

P.O. Box 4574
Lynchburg, Virginia 24502

SHAFFER & ASSOCIATES, INC. CONSULTING ENGINEERS

- FCC Applications • Propagation Analysis
- AM, FM, TV, LPTV, MMDS
- Radiation Field Measurements
- Bid Specification Development

3050 Post Oak Blvd., Suite 1700
Houston, Texas 77056
Tel. (713) 621-4499 Fax. (713) 621-5751

Communications Engineering Services, P.C.

Coverage Predictions • Terrain Analysis
Propagation Studies
Computerization of Manual Engineering Systems
Site Selection • Frequency Allocations
FM, TV, Land Mobile, Cellular, Paging Services

Richard L. Biby, P.E.

6105-G Arlington Blvd. Falls Church, VA 22044 USA
(703) 534-7880
Fax: (703) 534-7884 root@comm-data.com

THE PORTABLE DEPOT, Inc.

SPECIALIZING IN GENERAL ELECTRIC PORTABLE SERVICE

- FACTORY TRAINED TECHNICIANS •
- SURFACE MOUNT TECHNOLOGY •
- FACTORY APPROVED NATIONWIDE •
- PUBLIC SERVICE TRUNKING •
- VOICE GUARD CERTIFIED •

• MPD, MPA, TPX, PCS AND ALL CURRENT PRODUCTS •
Route 2, Box 338C • Lynchburg VA 24501
804-237-3427

The Warner Group MANAGEMENT CONSULTANTS

- Radio/Microwave/E9-1-1
- D P Design and Selection
- Police/Fire/EMS
- Consolidation Studies

5850 CANOGA AVENUE, SUITE 600
WOODLAND HILLS, CALIF. 91367
(818) 710-8855

COMMUNICATIONS CONSULTING SERVICES



10 Woodbridge Center Drive COMMUNICATIONS
Woodbridge, NJ 07095 CONSULTANTS, INC.
(908) 636-6970

Toll-Free: (800) 247-4796 • FAX: (908) 636-7260

Offices Nationwide and International.



Jerry L. Simmons

Communications Systems Consulting
Land Mobile & Microwave Systems

P.O. Box 884 Ph (409) 588-3200
Montgomery, TX 77356 Fax (409) 588-4434

Classified

Advertising rates in Mobile Radio Technology's Classified Section are \$69.00 per column inch, per insertion, with frequency discounts available. There is a one inch minimum.

Ads larger than one inch are sized in 1/4-inch increments and billed accordingly, as determined by total size of the ad, including ruled borders and rounded up to the nearest 1/4 inch.

Blind box ads (replies sent to MRT for forwarding) are \$30.00 and Fast Fact reader service numbers are available for \$25.00 per service, per insertion, to cover processing and handling costs.

Optional color, determined by MRT on an issue-by-issue basis, is available at \$150 per insertion.

A prepayment discount of 5% is available for all 6x or larger frequency classified advertisements who prepay their full 12 month schedule.

No agency discounts are allowed for classified advertising.

Contact Jennifer Hinkle at (913) 957-1927 or fax (913) 957-1901 to place your classified ad. Or send your advertising materials and order to Tammy Kalebough, Mobile Radio Technology, Classified Advertising Department, 9800 Metcalf, Overland Park, KS 66212.

CELLULAR TWO-WAY PAGING PERSONNEL SERVICES

Positions Available Nationwide

- Executive • Management • Marketing
- Sales • Engineers • Technicians

Fees client paid. Send resume to address below

PERMANENT & CONTRACT PERSONNEL AVAILABLE

- Extensive national resource of personnel
- Reasonable fees

Employers: Call 606-491-5410 10 AM to 8 PM



Communication Resources

P.O. Box 141397 • Cincinnati, OH 45250
606-491-5410/FAX 606-491-4340

Help wanted



• Two-Way Radio
• Cellular
• Paging
• Wireless
Communications
C.K. Randal
Recruiter

3598 Larchmont Square Lane
Sacramento, CA 95821
Office: (916) 482-7701
Fax: (916) 482-7808

TWO-WAY TECHNICIANS

Western Wisconsin Motorola (MSS) shop of 35 years is seeking an experienced two-way radio technician. We service all Motorola equipment. A minimum of 2 years experience needed. FCC license or NABER certification is required. Please send resume to:

RASSBACH COMMUNICATIONS SERVICE, INC.
404 Ferry Street
Eau Claire, WI 54703

WANTED Applications Engineer

To perform customer technical support for international antenna manufacturer. Strong RF plus good articulation skills. Associates degree or better required.

Call 609-737-8500

Classified

CAREER SEARCH?

We have the opportunities!

Cellular/Wireless/PCS/Radio
Permanent & Consulting • Domestic & International
E. J. DORT & ASSOCIATES
P.O. Box 12546 • RTP, NC 27709-2546
919-544-9476

TWO-WAY TECHNICIANS

GLOBE, ARIZONA: MSS SHOP IS LOOKING FOR TWO-WAY TECHNICIANS EXPERIENCED IN ALL MOTOROLA EQUIPMENT, INCLUDING PAGERS, PORTABLES, MOBILES, REPEATERS, BOTH CONVENTIONAL AND TRUNKING, NEW AND OLD.

WORK INCLUDES: BENCH REPAIRS, FIELD REPAIRS, TOWER WORK, AND INSTALLING.

MUST BE FCC LICENSED, NABER CERTIFIED OR EQUIVALENT.

PLEASE SEND RESUME TO OR CALL:

ROY D. HUDGINGS
SHORES COMMUNICATION CO., INC.
P.O. BOX 2626
GLOBE, ARIZONA 85502
PHONE: (602) 425-5870

EXPERIENCED BENCH TECHNICIAN

GE/E.F. Johnson SMR operator seeking experienced bench tech. We offer a stable position with established company; profit sharing, medical, paid vacations. Salary D.O.E. ... up to \$32,000 starting. Send resume.

ADVANCED COMMUNICATIONS

593 Overmyer
Sparks, NV 89431

For Sale

Centra Com I Centra Com II

-Whole or in Parts-



Centra Comm II
Engraved Buttons.
\$6.50 per button.
All orders shipped
within 48 hours.

*Centra Com II
Reprogramming and
Custom Changes*

Northeastern Communications Inc.
Waterbury, CT 06708
(203) 575-9008

For Great

LABELS

CALL

Anchor Graphics, Inc.

We carry Radio Escutcheon

- Logo design
- Knowledgeable staff
- Custom-made labels
- Quick turnaround
- Full-service Label Mfg.

Tel: (214) 242-0439 • Fax: (214) 242-0959

1467 LeMay, Suite 111 • Carrollton, TX 75007

Help wanted

PageNet, the largest paging company in the U.S., has recently expanded into Denver, San Antonio and Orlando, and has aggressive plans for continued growth nationwide. **Immediate openings exist in various cities throughout the U.S. for the following:**

System Manager

In this position, you will have responsibility for the design, engineering, construction and continued growth and reliability of the complete paging system. Knowledge of paging systems and/or RF transmitters is desired. **Dept. SM-MRT.**

System Technician

You will have responsibility for installing and maintaining base stations and paging terminal equipment. At least 1 year experience with paging or two-way FM transmitters is required. **Dept. ST-MRT.**

We offer competitive salaries and a full benefit package. Qualified applicants should send resume, indicating appropriate Dept. code, **Immediately by FAX to (214) 985-6896 or mail to: Paging Network, Inc., 4965 Preston Park Blvd., Suite 500, Plano, TX 75093.**

PAGENET

Equal Opportunity Employer
No Phone Calls Please
Principals Only

Equipment for sale

Channel Elements

100,000 Freqs in Stock!
MASTR II, MVP, EXEC II
MICOR, MOCOM & MOTRAC

\$20 w/trade or \$25 w/o trade
Lifetime Warranty
3-Day Standard Delivery
1-800-237-9654

FAX: 513-542-8870

CHANNEL ELEMENT HQ.

4120 Kirby Road
Cincinnati, OH 45223

We Buy Channel Elements.

MOTOROLA CENTRACOM I & II

Console components
BOUGHT & SOLD
Telecommunications
Engineering Associates
409 Wildwood Dr.
So. San Fran., CA 94080
Ph: (415) 871-4200

Circle (141) on Fast Fact Card

Towers and Land For Sale

Former Western Union Sites in 20 States.
Land, buildings and towers plus some
microwave equipment for sale. Prices vary
by location. For details call Agents Joyce
Castille or Jim DeCicco.

800-852-8166 or 619-497-3458



Mobile Communications



Call CA today
for reliable and
affordable
radios!



MONOGRAM™ SERIES

VHF, UHF Portable and Mobile
Two-way Radios for Value-Packed
Communications!

distributed by
**CA Communications
Associates Inc.**

(800) 435-9313

In Illinois (800) 892-1611

Order Fax (800) 284-4934

Circle (143) on Fast Fact Card

Classified

Equipment for sale

**MOTOROLA UHF
SUPER CONSOLETTES
WIDE SELECTION**
→ \$295. - \$695. !
800-231-0103

MIDLAND LMR Nationwide LAND MOBILE RADIO

**Factory Approved
WHOLESALE PRICES**

**Land Mobile
Dealers Only**

- Large Inventory • Fast Service • Flat Rate Repair Service
- Complete Dealer Support Program

(800) 726-9015
(612) 869-2487

SAME DAY SHIPPING

Call for Weekly Specials!

Refurbished Equipment Available

FAX (612) 869-3078

RCW

DISTRIBUTING

816 W. 77½ Street
MPLS, MN 55423

Circle (120) on Fast Fact Card

PAGERS FOR SALE
ALL FREQUENCIES AVAILABLE
PAKERS FOR SALE

**ONE ONLY
PAGERS**

ENVOY

BRAVO TONE

D3 TONE

FOURTH DIMENSION INDUSTRY, INC.
WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER

3300 Dayton Court, Hollisbrook, New York 11711

800-231-0103

RAMSEY COM-3

*The communications service monitor that's
missing one feature . . . HIGH PRICE !*

- Frequency coverage 100 KHz to 999.999 MHz
- Signal Generator 0.1 uV to 10,000 uV with reverse power protection . . . no more front-end blowouts!
- Built-in 1 GHz and audio frequency counter
- Modulation includes 1 KHz, CTCSS or external
- The most popular low cost high performance monitor. . . thousands sold worldwide
- Extremely portable, only 13 pounds includes rechargeable battery at no extra cost
- Call for free 10 day trial in your shop



Ramsey Electronics Inc.

793 Canning Pkwy
Victor, NY 14564

716-924-4560

716-924-4555 (FAX)



\$2995.00

Circle (121) on Fast Fact Card

CLEAN MOTOROLA CONVENTIONAL RADIOS

MOBILES

100W UHF MARATAC A7 99F SCAN (NEW)	\$1195
A7 (USED)	\$795
100W VHF MARATAC A3 16F (NEW)	\$995
100W VHF OR UHF MITREX 4F PL 3 DPL	\$450
100W UHF MICOR 12F PL RECONOT D CLEANEST IN USA	\$150
25W VHF OR UHF MAXTRAC 16F SCAN - \$395 45W 16F	\$445
45W VHF SPECTRA A3 99 MODES NEW IN BOX	\$995
30W 900 MHZ SPECTRA "AS" WITH ALL ACCESSORIES	\$595

PORTABLES

2W VHF EXPO WITH RAPID CHARGER MINT CONDITION	\$325
5W VHF OR 4W UHF P200 & HT600 6F	
PERFECT CONDITION	\$445
4W UHF OR 5W VHF HT50 2F WITH CHARGER AS NEW	\$325
2W VHF SABER 11 DVP CAP NEW IN BOX ONLY 4 LEFT	\$995
5W UHF SABER 111 W/RAPID CHARGER AS NEW	\$1,495
CONVERTA-COM MT 1000/11000/MTX800/MX	\$295

RADIO EXPRESS, INC.

703-266-1928 FAX 703-830-8710 ORDERS ONLY 800-545-7748
"WE BUY USED MOTOROLA & RADIUS RADIOS"

The New Way To Re-Crystal!

**Top Quality Ultra-High Shock Crystals For Pagers & Radios
Motorola, GE, NEC, and all others!**

Priority Delivery Available:
24 hr./72 hr./5 day/10 day
Standard: 15 days

Your old friends at Standard Communications' Crystal Division are now your old friends at Frequency Management. We've formed an independent company to serve you better. Greater Capacity, New Larger Facility, Same Experienced Pros.



**Frequency
Management**

A Division of The D W. Thomas Companies, Inc.

15302 Bolsa Chica St., Huntington Beach, CA 90649 800/800-9825 (FAX 714/890-1832)

Circle (122) on Fast Fact Card

ACTIVE FILTERS

AND

REEDS

FOR MOTOROLA PAGERS
FAST DELIVERY

Bramco.

PH (513) 773-6255

P.O. BOX 1482, PIQUA, OHIO 45356

COOK'S COMMUNICATIONS

GE

LTR

160 N. Broadway
Fresno, CA 93701



**VISA
MASTERCARD**

**MOBILE AND PORTABLE RADIOS AT
WHOLESALE PRICES**

1-800-233-8818

Classified

800, 900mHz,
& Cellular
Antennas.

0-10dB Gain
Base & Mobile
Free
65p Catalog,
Poster & Brchur

"once you try our Euro
glass mint, you'll never
go back"

★ **AMERICAN-MADE:**
High-Quality, Lifetime Warranty

★ **EUROPEAN DESIGN:**
Sleek, Modern Appearance

★ **LOW-PRICES:**
You Don't Have To
Settle For The Imports

Antenna
World

9500 NW 12 ST Miami FL 33172

Fax: 1.800.237.3251 (305.471.9520)
Call: 1.800.637.0222 (305.471.9507)

Circle (125) on Fast Fact Card

Equipment for sale

Sharp
COMMUNICATION



Mobile
Communications

- trunked & conventional
- mobiles
- portables
- accessories
- FREE programming

Official Distributor for:
RFI Connectors-Cables-Accessories
Telewave Site Management Equipment
Whelen Strobes & Safety Signals

Call for our current flyer!

WHOLESALE to DEALERS ONLY



Sheila



Paige

QuikShip
1-800-548-2484

Order Today—Ship Today!

Circle (124) on Fast Fact Card

MOTOROLA Radius DELIVERY NOW!

Every Model in Stock! Free Programming of all new units on Delivery!
Will Positively Be Shipped Tonight!

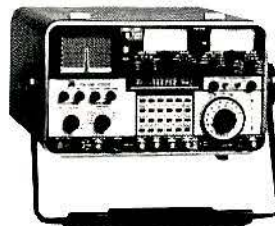
On your jobsite tomorrow. We can handle any size order and have
done so for 19 years.

CALL 1-800-53-RADIO (72346)
FAX (706) 568-4506

To place your order, even if you live in Hawaii, Virgin Islands, Alaska or
Puerto Rico. **RADIO WHOLESALE - John Cunningham WB4-JUN.**
One of the largest stocks of Motorola Radius in the world.

Circle (126) on Fast Fact Card

LOOK WHAT PRIMUS HAS IN STOCK FOR SAME DAY SHIPMENT TO YOU...



FEATURES....
PERFORMANCE....
and DEPENDABILITY...
THE IFR
COMMITMENT

primus

ELECTRONICS CORPORATION
800-435-1636 (IL) 800-892-1413 FAX 800-767-7605

Circle (127) on Fast Fact Card

MOTOROLA TRUNKED RADIOS

MOBILES 800 MHZ TRUNKED	
15W 10 EACH COVERAGE PLUS MOBILE W/LORAN RCVRS KEYBOARD & MAC COMPUTER W/SOFTWARE MINT	\$25 K.
15W TRAXAR W/MIC BRACKET & POWER CABLE	\$250
15W MOSTAR W/MIC BRACKET & POWER CABLE FROM	\$295
15W MAXTRAC B1 & B5	\$495 B6 & B7 \$545
35W MAXTRAC B1 & B5	\$545 B6 & B7 \$595
35W SYNTOR X MULTI SYS	\$495 SYNTOR X 9000E \$995
35W SYNTOR X 15 SYS/15 SUB/TALKAROUND "NEW"	\$995
35W SPECTRA B5 10 SYS/SCAN/TALKAROUND	\$995
25W PP1000	\$695 PP1000X \$995
BASE STATION PACKAGE P/S, DESK MIC, & TRAY	\$150
PORTABLES 800 MHZ TRUNKED	
2W MTX800	\$550 MTX800 6 SYS/3 SUB \$645
2W MTX810 6 SYS/3 SUB/CONVENTIONAL	\$695
3W STX 15 SYS/15 SUB SUPER CONDITION	\$995
3W STX SMARTNET NEW UNIT WARRANTY	\$1,295
3W STX SMARTNET 1/11/111 GEMINI "AS NEW"	\$1,695
MOBILES 900 MHZ TRUNKED	
12W B6 & B7 MAXTRAC	\$595 30W B7 MAXTRAC \$695
12W B2 SPECTRA	\$595 B5 SPECTRA \$695
30W B5/B7/B9 SPECTRA 10 SYS/SCAN/TEL	\$995
30W L37VLB BASE	\$995
PORTABLES 900 MHZ TRUNKED	
2W MTX900 B3 & B4 6 SYS/3 SUB/CONV	\$695
RADIO EXPRESS, INC.	
703-266-1928 FAX 703-631-1365 ORDERS ONLY 800-545-7748	
"WE BUY USED MOTOROLA & EF JOHNSON RADIOS"	

RadioMate®

We don't just manufacture headsets...
We design and engineer
headsets to meet your requirements!

Headsets For Most All Radios and Telephones

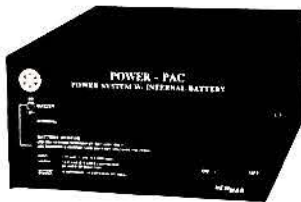


HCS Telecommunications (800) 346-6442

Circle (128) on Fast Fact Card

How To Tell If Your Base Station Needs A Newmar Power-Pac ... Pull the Plug.

If your communication system dies when you have an interruption in AC power, you need the NEWMAR Power-Pac. It's a 20 amp power supply with a built-in back-up battery which acts as an uninterruptible DC supply when AC power is down.



The Power-Pac's sealed deep cycle 7 amp/hour battery is normally floated at full charge by the supply. If AC power is interrupted, the battery automatically takes over powering the radio. This assures your communication system is up when it is needed most—during a power outage.

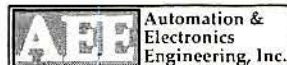
Power-Pac, when operating on battery back-up can power a 25 watt radio for up to two hours, based on a 20% tx/rx duty cycle. Indicators on the front panel alert the operator to system status.

Get your base station ready for the next power outage — Use a Power-Pac

NEWMAR
RELIABILITY BEYOND COMPARE

Phone: (800) 854-3906
Fax: (714) 957-1621

NEW IDEAS FROM



13667 Floyd Circle
Dallas, TX 75243
800-527-4596
800-383-9180 FAX

MULTI LINE SELECT

- Console style housing with handset or optional gooseneck mic
- Simultaneously monitor up to 8 BASE stations
- Flip a switch to monitor "ALL" or mute "ALL" except selected base stations
- Up to 8 channels available per base station
- LED display for channel selection

MLS SERIES DC OR TONE COMPATIBLE



Automation & Electronics Engineering, Inc.

Circle (130) on Fast Fact Card

RADIUS
WE'LL BEAT YOUR BEST PRICE!
California Radio 800-231-0103

PAGERS FOR SALE
ALL FREQUENCIES AVAILABLE
TONE / VOICE PAGERS
BPR 2000
SPIRIT
KEYNOTE
PAGERS FOR SALE
FOURTH DIMENSION INDUSTRY, INC.
WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER
3280 Dante Court, Holliston, New York 11741
(516) 732-2200
FAX 732-2297

• MOBILES • BASES • PORTABLES • PAGERS • REMOTES •
PCI — PEKAAR COMMUNICATION INC.
Steve's back, formerly of Gregory Electronics Corp.
\$ Specials of the month. \$

GE Phoenix SX Model N5VW2W22B—470-490 range w/accessories	\$185
Motorola TMN 1004A base microphone	\$30
Motorola Radius Model D34LRA73 Mobile 450 Range w/acc.	\$300
Motorola Mitrec Mobile P34JJA3000 450 Range w/acc.	\$225
Motorola Veh. charger Model N1244A for MX series Portable less accessories	\$40
Coded Communications TACTEC Systems MMA64A HB w/accessories	\$125
GE Mastr II Base Mic	\$20
RCA Veh. Charger 4 TACTEC	\$25
GE Delta Mobiles N3HH Crystal Style HB 40 Watt less accessories	\$50
GE Mastr Pro Mobile MT74TAS33 100 Watt 42-50 w/accessories	\$50
Regency BTH201 HB w/accessories	\$45
Regency Model TR201 HB w/accessories	\$75
GE Portable MPR Model P2BR56 450-470 range single freq.	\$75
GE PE Portables—Most ranges T.S. AS IS	\$25
Motorola Motrac or Mocom speaker	\$5.00 ea

Catalog Available If you can't find it, try us! Call (201) 772-0704

• BOARDS • STRIPS • ACCESSORIES • ELEMENTS • REEDS •

Circle (131) on Fast Fact Card

MOTOROLA/RADIUS Radio Conversion Software
SAVE BIG BUCKS, CONVERT-UPGRADE YOUR OWN RADIOS
GP300's, P110's, M100's, M214's, GM300's, LTR's
MAXTRAC, PRIVACY PLUS SMARTSITE & MORE
OUT OF BAND PROGRAMMING — BOARD BLANKING
LIMITED FEATURE 2 CHANNEL TO FULL FEATURE 16 CHANNEL

C+ SOFTWARE
USA & CAN. 1 (800) 561-3140

ORDERS ONLY

Circle (132) on Fast Fact Card

Classified

Equipment for sale

• PAGERS • PAGERS • PAGERS • PAGERS • PAGERS •

Authorized Dealer
NEC Paging Products



McManus Communications

501-763-6250

FAX 501-763-6533

"WE SELL"

- ▶ Refurbished Motorola & NEC Pagers
- ▶ Parts for Motorola, NEC & Panasonic Pagers
- ▶ Programmers
- ▶ Reeds, filters, code plugs, etc.

* Used Pagers WANTED

"ONE CALL GETS IT ALL"

- ▶ Stocking common PCP & RCC Channels
- ▶ Stocking Panasonic Synthesized Pagers

• PAGERS • PAGERS • PAGERS • PAGERS • PAGERS •

Circle (133) on Fast Fact Card



GENERAL COMMUNICATIONS, INC.

MOBILE COMMUNICATIONS AUTHORIZED DEALER

#1 GE DEALER IN THE USA!

Largest Inventory ▲ Quality Service
Fastest Delivery and Best Prices



1-800-356-3200



Mobile Communications

5157 Anton Dr. ▲ Madison, WI 53719

Circle (136) on Fast Fact Card

COMPLETE CHANNEL ELEMENTS ON YOUR FREQUENCY FOR

\$25 - \$35!!!

ORDERS ONLY:

1-800-237-6519

INQUIRIES AND IN LA:

504-361-5525

- ☐ Motrac; Micor, Mocom; Mitrek; Etc.
- ☐ MT's, and GE Elements. Call for prices.
- ☐ Any desired Frequency available for fast delivery.
- ☐ Lifetime Warranty on Crystals
- ☐ Trade-in credit on your Old Channel Elements
- ☐ We Buy Used Elements

Try us first. We always have your frequency available.

NKX

1814 Hancock St.
Gretna, LA 70053

USED PAGERS

Motorola and NEC. Reconditioned on your channel w/warranty, or "as is".

ACS

(303) 337-4811

FAX (303) 337-3084

MICORS! 100 Watt

42 - 50 Mhz With PL 1 or 4 Ch.
With all accessories & tested

\$269. 800-231-0103
CALIFORNIA RADIO

ACSB REPEATER & MOBILES FOR SALE

NEW — NEVER USED — IN ORIGINAL BOXES

1—Stephens 175R VHF repeater w/community tone panel, C.W. identifier, phone patch with reverse capability and antenna duplexer, 5—Mobile 175 with tone board, DTMF decode and encode. Will ship. Asking \$5,000.

JTI Inc., Cleveland, OH 216-232-4311

Ask for Ed 1-800-458-4462

Hy-Q International (USA)

☐ **PAGER CRYSTALS**

☐ **COMMUNICATION CRYSTALS**

☐ **CHANNEL ELEMENTS**

☐ **Recrystallized**

☐ **Complete Elements**

48-HOUR SERVICE AVAILABLE

(606) 283-5000

FAX: 1-606-283-0883

1438 Cox Ave., Erlanger, KY 41018

(Greater Cincinnati Area)

"Precision Quality Quartz Crystals—
Made to Your Specifications"

Circle (134) on Fast Fact Card

Now, here's a switch!

CHARGE GUARD®

automatic ON/OFF timer switch
for two-way radios cellular phones

EASY TO INSTALL.

NO IGNITION SWITCH CONNECTION!

PROGRAMMABLE.

15 MINUTES TO 15 HOURS!

Prevents Dead Batteries.

MADE IN U.S.A.

PROTECTS YOUR RADIO.

SUGGESTED LIST ONLY \$74.95 MODEL CG-1B 12N

12 AND 24 VOLT MODELS AVAILABLE

CALL NOW FOR MORE INFORMATION!

ASK ABOUT
OUR NEW
DEALER KIT!



CHARGE GUARD®

400 Highland Avenue
Altoona, PA 16602

800-458-3410

Circle (135) on Fast Fact Card

**Motorola/Radios Upgrades
and Conversions**

GP-300/P-110 16 Channel Kits

• Complete kit \$44.95

Standard Programming and Repairs also available



RadMax Communications

COMPLETE COMMUNICATIONS SERVICE
10677 Indianwoods Drive, Cincinnati, Ohio 45242
513-489-1732

Classified

Equipment for sale



Visit our shop at 1003A
Tyler Street in Fredericksburg.
Direct all correspondence to our
P.O. Box.

P. O. Box 7846 Fredericksburg, VA 22404 (703)373-3888

Visa and Mastercard are accepted for your convenience

Bases and Repeaters

72-76 MC 25W PL Repeater
142-150.8 MC 100W C.S. 4F Base
150-162 MC 100W C.D. PL Repeater
150-162 or 162-174 100W C.D. DES Repeater

Mobiles

T73VXJ Syntor X DVP 100W 148-174
T73VBJ Syntor X 100W 148-174
T8SRA Syntor 100W 150-162
T74VBJ & T74SRA 406-430
MCX100s 136-162 & 148-174
Some with Scan; DES; PL & DPL

Mitres

60W 29.7-39.00 MC & 39-50 MC
45W & 100W 148-174
100W 450-470

Micors (CHEAP)

42-50 100W 12F Extender C.S. PL
142-150, 150-162, 162-174 45 & 100W 4F
406-430 100W 4F & 8F
P43XS DVP Suitcase Repeater
MX Repeaters
MBX Briefcase Base DVP/DES 30W
DES; DES XL; KVL's and cables

We have the R1801 DAC for your programming needs. Call us with your requests.
Come See Us at Dayton (Space 1608 and 1609)

Circle (137) on Fast Fact Card

COMPATIBLE MOTOROLA® RADIO PROGRAMMING EQUIPMENT

BUY WITH CONFIDENCE. COMPARE OUR QUALITY.

PROGRAMMING ADAPTORS

PA-1 \$169.00

- ✓ Supports full spectrum of programmable Motorola® Radios
- ✓ IBM AT/XT compatible

PA-2 added features \$195.00

- ✓ Rechargeable NI-CAD battery
- ✓ Data and Active indicator lights

AMERICAN MADE



*Note: Hardware Only. Software sold by Motorola, Inc.

PROGRAMMING CABLES

Our Programming Cables are precision devices designed specifically for each radio. Put your confidence in our quality engineering.

WE OFFER:

- ✓ Precise metal frames designed for each radio
- ✓ Quality P.C.B. designed for each radio frame
- ✓ Battery Eliminator option
- ✓ GOLD connector pins
- ✓ Coil cords
- ✓ 1 Year Warranty

DON'T SETTLE FOR:

- ✗ Inferior designs
- ✗ Velcro straps
- ✗ Cheap construction
- ✗ Plastic rigged boxes

Reference ad for TELEPHONE SPECIALS on radio programming cables

Full line of radio cables available: GP300/P110, HT600, HT50/P100, MT1000, RADIUS® MOBILE, MAXTRAC®, SPECTRA®, STX®, SABER and others.

POLARIS INDUSTRIES

a Division of Southern Computer Corp.
141 W. Wilecia Rd., Suite 300B
Atlanta, GA 30342-3219

CALL FOR A FREE BROCHURE

24 HOUR ORDER LINE 800-752-8571

24 HOUR FAX LINE 404-252-8829

ORDER BEFORE 1PM AND WE WILL SHIP SAME DAY

Motorola® and other products are trademarks of Motorola, Inc.



MasterCard
VISA
DISCOVER
C.O.D.

Circle (138) on Fast Fact Card

BUYING ERICSSON - GE EQUIPMENT CALL OR FAX FOR QUOTE

Ranger VHF 110W w/S550 scan\$650
MASTER II STA. 100W 42-50 from1,200
C73JZB-II06A MOT. PERK STA1,800
CUSTOM MVP 42-50 w/acc125
CUSTOM MVP, VHF w/acc125
MVP HOUSING PANELS PARTS KITScall
Delta-S 150-174 no. acc. 110W275
Delta-S 450-470 40W S-990 acc.299
Delta-S 450-470 40W no acc.199
Delta-S Low band and "T" bandCall
VHF PLS Port. 16 ch w/GESTAR199
PLS/MPD/MPA Multi-chrg. new100
Phoenix-SX 406-430 16 ch. new225
MASTR II 150-174 110Wfrom 115
MASTR II 450-470 40W165
MASTR II VHF "E" package, 110W
DPE W/C-500 scan accessories150
S-990 128 ch. head w/warranty125
NEW CELLULAR HANDSETS & OPTIONS call
MPS/MPR/MPX/MP1/MPD Chargerscall

NEW LONDON TECHNOLOGY

231 Old Timberlake Road

Forest, Virginia 24551

TEL 804-525-0068 FAX 804-525-0078

BUY - SELL RADIOS

NEW & USED

Johnson - Motorola

Standard - Uniden

Buy-Comm-Co.

Steven Kenney

1-800-347-4121

(602) 585-3900

FAX (602) 585-6900

29669 North 45th Street
Cave Creek, Arizona 85331



RADIUS

★low-low-low★

MOSS COMMUNICATIONS INC.
1-800-767-1963



STOCKING DEALER

SAME DAY SHIPPING

FULL PRODUCT SUPPORT

WHOLESALE TO DEALERS ONLY

MAJOR CREDIT CARDS ACCEPTED

LARGE INVENTORY OF MOBILES & PORTABLES

B & C Communications, Inc.

1-800-343-3004 - 201-670-1985 - (Fax) 201-670-7627

Circle (139) on Fast Fact Card

Mobile Extender DGME 1000

Digital Gated Repeater Maker DGRM 501

The DGRM 501 provides for repeater operation while the DGME 1000 provides for mobile extended operation with use of most any two transceivers. Repeater: 1 strand, Cross Band & Link, 1-sec 1-sec Eliminator. Digital gate circuit for positive control and min. power draw. DGRM 501 & 501B ideal for remote locations.

DGRM 501 \$89.00 DGRM 501B & DGME 1000 \$169.00

Order 1-800-283-5158

1 year limited warranty

NEW! Programmable Delay Timer DG 200 Series

This unit provides control of radio with delayed shut down after ignition is turned off. The DG 200 Series is a dip switch programmable timer with delayed time settings of 15 min to 12+ hrs. This unit will handle 30 continuous amps at 12V. The DG Series timer eliminates battery failure due to leaving mobile, computer, AVL, MDT, Trunking or other equipment inadvertently.

COMM-NET 2000

COMMUNICATIONS/MANUFACTURING

P.O. Box 20 5407 N.E. Stephens

Winchester, OR 97495 Fax (503) 672-6475

Protects your radio!



Mounting Case & Hardware Included.
DG 200 Series \$38.00

Classified

PAGERS FOR SALE

ALL FREQUENCIES AVAILABLE

TONE ONLY PAGERS

ENVOY

BRAVO TONE

D3 TONE

PAGERS FOR SALE

FOURTH DIMENSION INDUSTRY, INC.

WORLD WIDE COMMUNICATIONS EQUIPMENT BROKER

3000 Deane Court, Hollisbrook, New York 11411

516-777-3220

Fax 516-777-3220

Equipment for sale

CRYSTALS FOR ALL RADIOS

Communication Crystals

All makes and models

Channel Elements

Recrystallized and compensated

COMPETITIVE PRICING!

Emergency Service

For Crystals: 24 Hours 72 Hours 1 Week
Normal Delivery: 1 Week

800-333-9825

CAL CRYSTAL LAB, INC.

1142 No. Culbert, Anaheim, CA 92801 • FAX 714-491-9825

LOWEST PRICES IN USA...GUARANTEED! UNITS SHIPPED PROGRAMMED

PORTABLES / PAGERS

P-50 5W 1F PL/DPL VHF	\$279	4W 1F PL/DPL UHF	\$299
P-110 2W 2F PL/DPL VHF	\$340	2W 2F PL/DPL UHF	\$369
P-110 5W 4F PL/DPL VHF	\$375	4W 4F PL/DPL UHF	\$399
GP-300 5W 2F PL/DPL VHF	\$440	4W 2F PL/DPL UHF	\$470
GP-300 5W 8F PL/DPL VHF	\$470	4W 8F PL/DPL UHF	\$499
PR3000 PAGER VHF	\$259	Tone & Voice UHF	\$270

MOBILES

M-100 2F 25W VHF	\$316	2F 25W UHF	\$365
M-100 2F 45W VHF	\$371	2F 40W UHF	\$421
M-216 16F 25W VHF	\$387	16F 25W UHF	\$434
M-216 16F 45W VHF	\$416	16F 40W UHF	\$467

RADIO EXPRESS, INC.

DFC 703-266-1928 FAX 703-830-8710

ORDERS ONLY 800-545-7748

USED 2-WAY RADIOS

Call Sid Cohen

at AIR COMM—Phoenix, AZ

(602) 275-4505 • Fax (602) 275-4555

30%-70% savings on Motorola, GE, EFL mobiles, base stations, portables, pagers, repeaters—primarily solid state—all frequency bands. Also, accessory items: Motorola "Systmes 90" control heads. PL and paging reeds, channel elements. Cash quotations made for purchase of above equipment.

AIR COMM

4614 E. McDowell Rd.
Phoenix, AZ 85008

MITREKS for SALE!

450 - 470 Mhz. 4 Ch.

(30 w = \$195. 50 w = \$295.)

California Radio 800-231-0103

CUSHMAN

Service Monitors

CE4, CE5, CE6

Good Working Cond.

Call For Best Price

VersaTel Ph: 1-800-456-5548
Fax: 1-307-266-3010

YOUR STOCKROOM HAS IT ...



THE COMMUNICATIONS EXPRESS

US 1-800-631-7297

FAX 1-800-327-0007

Circle (140) on Fast Fact Card

Swersweep

SWR Measurement Kit

Swersweep is designed to work with modern service monitors with tracking generator and spectrum analyzer enabling a plot of SWR vs. Frequency on the CRT display. Swersweep allows the instrument to function as a scalar network analyzer. See feature article on page 64 of October 1989 Mobile Radio Technology for more information.

Uses:

- Tuning Antennas: Base, mobile, or glass
- Tuning cavities, duplexers, or filters
- Tuning preamps and Receiver front ends
- Checking transmission line and trimming to resonance

Each Swersweep is hand built with calibration traceable to the National Bureau of Standards.

1-500-MHz \$350. 1-1000-MHz. \$675

Prices include shipping

Europa Marketing

2358 S. Patterson Mesa, AZ 85202

Phone: 602-345-6666

RTX Corporation

Advanced Turn-Key Trunking
Radio-Telephone Systems
Designed and Installed

Anywhere • Any Frequency • Any Size

RTX Puts You On The Air

1-800-848-4RTX

4000 Dow Rd., Melbourne, FL 32934

NEW! Tone-Master™ Touch Tone Decoder



MoTron Electronics

310 Garfield St., Suite 4 Eugene OR 97402

Info: (503) 687-2118 Orders: (800) 338-9058

Fax: (503) 687-2492

Decode and display Touch Tones from a tape recorder, scanner, or nearly any audio source. ✓ 16 digit LCD display, 80 digit scrollable buffer ✓ Built-in speaker ✓ 9V battery ✓ Metal case ✓ TM-16 PLUS includes RS-232 output and Software for optional date/time/number logging using your IBM Compatible computer.

TM-16 Standard Model	\$229
TM-16 PLUS RS-232 Model with Software	\$299
PS-12 AC Power Adaptor	\$10

S/H \$5 USA/Canada, \$15 Foreign.

Visa, MasterCard & American Express Accepted

BUY — SELL — TRADE

Micor Base/Repeater	from \$1295
Master II Base/Repeater	from \$1295
Mocom 70 Consoles	from \$250
Mocom 70 Mobiles	from \$100
Micor Mobiles	from \$150
Mitre Mobiles	from \$150
Maxar, Radius, Traxar Mostars	from \$150
Master II Mobiles	from \$150
EX II Mobiles	from \$100
Phoenix/Centura/MVP	from \$150
DC/Tone Remotes	from \$100
Pulsar II/III VHF/Bell	from \$395



Bob Barnett
Owner — W5RAH
FCC 1st Class Tech
30 Years in
Communications

Bases/Repeaters/Mobiles
No Used Pagers-Portables or Parts
Cash + Shipping Paid Promptly
Call For Quote or Sales List
Warehouse 1-501-835-7066
Fax 1-501-835-8766

BARNETT ELECTRONICS

8718 Wilhite Lane • North Little Rock, AR 72120

CELEBRATING OUR 20th ANNIVERSARY!!

CALL TODAY TO CHECK OUR
ANNIVERSARY SPECIALS

BUY — SELL — TRADE

Call or write for current flyer

WOLFE COMMUNICATIONS

1113 Central • Billings, MT 59102

406-252-9220

Classified

Equipment for sale

*** RECONDITIONED ***
MOTOROLA
 Mitrek, Micor, Maxar, Radius, Maxtrac
 **800-231-0103**
 CALIFORNIA RADIO

USED RADIOS at Low Prices!

- MICOR
- MITREK
- PORTABLES
- MOCOM 70
- MAXAR
- RPTRS
- GE
- RCA
- ACCESSORIES
- TONE ELEMENTS
- CHRYSTAL ELEM
- BASE STATIONS

Large Quantities • (817) 433-5452

REPAIR SPEAKER MICS FOR MOTOROLA PORTABLES.

Tom Miller Electronics
 22516 S. Normandie 41B
 800-995-8964 310-320-8980

RAPID COMMUNICATIONS

G.E. PLSU04 (USED)	\$250.00
MOT P-100 UHF (NEW)	350.00
P-110 VHF (NEW)	372.00
P-110 UHF (NEW)	405.00
GP-300 VHF (NEW)	452.00
GP-300 UHF (NEW)	484.00

(800) 377-3807



Bought, Sold & Repaired
 Free 2 year warranty on new radios

SWS SECURITY
 800-SPOT-CRIME



GE WHOLESALE DISTRIBUTION CENTER

(a division of D&L Communications, Inc.)

- Million Dollar Inventory
- Less than Wholesale Prices
- New and Used, Buy and Sell
- New Dealer Packages



Mobile Communications

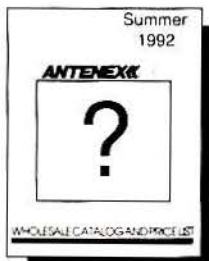
1-800-336-6825

"Find Out What Everyone Is Talking About!"

ANTENEX
 2000-200 Bloomingdale Road, Glendale, IL, U.S.A.

Call or write for complete catalog on
 ANTENEX mobile, portable, and
 base antennas, mounts, cable,
 connectors, and accessories!

Order: 800-323-3757
 Fax: 800-851-9009



GENERAL COMMUNICATIONS

MIDLAND LMR
 LAND MOBILE RADIO

**WHOLESALE PRICES ON ALL
MIDLAND RADIOS!**

CALL TODAY!



1-800-356-3200

5157 Anton Dr.
 Madison, WI
 53719

NOW AVAILABLE



**1993 MOBILE
MOUNTING
GUIDE**

Made in the USA FOR MOBILE OFFICE OR
PUBLIC SAFETY NEEDS

Call for a Free Copy
1-800-523-6180

**SCIENTIFIC DIMENSIONS
INC.**

**WE BUY AND
SELL USED
MOTOROLA
AND GE
FM TWO-WAY
RADIOS**

**SCHAEFER
RADIO CO.**

1301 Grant St.
 Box 395
 Denver, IA 50622
 (319) 984-6115
 FAX (319) 984-6220

- 2 SPECTRA 900MHz Trunked, D37KGA51B7AK
- 20 SYNTOR 800MHz Trunked, T45XJ5G11AK
- 35 MISTAR 800MHz Trunked, D35TLA5G00
- 73 GE CDP09A 800 MHz Trunked
- 23 GE MARS V Portables, 800MHz Trunked
- 5 MICOR Rptrs 460MHz, C24RCB3135T
- 13 MOTRAC Rptrs 460MHz, C24MSY3101T
- 2 MT500 500MHz, H34BRU3144
- 26 MICOR 495MHz, T4RTA3000
- 44 SYNTOR 495MHz, T64SRA3200
- 30 MICOR 460MHz, T74RTA3000
- 50 SYNTOR 460MHz, T64SRA3200
- 10 MAXAR 50 460MHz, D34TSA3000
- 180 MX340 460MHz, H41AAU3140
- 107 MT500 460MHz, H4BRU3120
- 116 H1220 460MHz, H24FA3110
- 21 MICOR 173MHz, D30MTX000
- 10 MAXAR 80 173MHz, D43TSA3000
- 6 SYNTOR 173MHz, T83KTA1200 (w/DVP)
- 7 MICOR 155MHz, T83JA3000
- 126 MICOR 155MHz, T73RPS3100
- 5 MT500 155MHz, H33BB3184
- 2 MICOR Bases, 72MHz, Net Standby, 01080A
- 28 MITREX 45MHz, T61JJA500
- 2 MOCOM 70 48MHz, T118BA1000
- 9 GE MASTER II 48MHz, MC74CES33
- 28 GE MASTER PRO 48MHz, MT74TAS33
- 2 GE EXEC II 31MHz, T17AA313AH
- 48 MOCOM 10 31MHz, D41MAN1300
- 28 DC Remote Desk Sets, T1376
- 5 Local Desk Sets, SFCODE
- 12 STANDARD C9662 48MHz

RADIO PAGER CRYSTALS Specializing in MOTOROLA NEC UNIDEN

Precision crystals at affordable prices.
 Common frequencies for popular pagers in stock.
 Custom order and specialty crystals welcome.

★★ SAME OR NEXT DAY SHIPPING ★★

CRYSTRONICS, INC.
 We've got the crystals

Phone 305-566-6949 Fax 305-566-5971

USED TEST EQUIPMENT AND RADIOS

- 1—HELPER Millivoter RF801-LIKE NEW! Lists for 82500 / Sell for 60000
- 1—W&W Associates "Analyzer I" NiCad battery tester and reconditioner. Adjustable from 3 to 20 cells and up to 1800 MAh. Clean-Works Good. List 100000 / Selling for 50000
- 9—Ritron RT-450 UHF 1 watt walkies with CTCSS, battery, antenna, chg., and most have swivel belt loop. Now on 464.675 / Selling for 7500 each.
- MISC—Many new, some used, all working Motorola, Johnson, Regency and other base units, mobiles and walkies. Send a SASE for a complete list and prices.

PATRICK ELECTRONIC'S INC.
 3701 Old Jenny Lind, Ft. Smith, Arkansas 72901
 501/646-6141

XPM COMMUNICATIONS

ICOM Land-Mobile, Marine, & Aviation, Vtech
 Local, Regional, and Nationwide Paging Services
 Power Surge Suppression and Backup systems
 Discover/Mastercard/Visa/Optima/AMEX

XPM

(800) 753-4XPM or (210) 693-4999

UNIDEN ARX800
 LTR LOGIC BOARDS

NEW — \$500

(504) 947-4743

8:30 AM — 5:00 PM CST

MITREKS!

110 Watt, PL or DPL, 4 channel
 29-39 or 39-50 Mhz. MINT!

\$495. 800-231-0103

Classified

Equipment for sale

★ GE MASTR II REPEATERS ★

UHF & VHF — Duplexers
Motorola Centracom I console
Best Offer

601-264-9760

**STOP
AND
SAVE!**

MOTOROLA RADIUS

End users shop
first then call for
best price.

Procomm
805-497-2397

STICKERS, LABELS, NAMEPLATES

ADVANCE LABEL & TAG

1725 N. McDONALD ST.
McKINNEY, TEXAS 75069

1-800-466-5345 214-542-5345

We design and manufacture LABELS that
STICK and guarantee the QUALITY.

CALL FOR FREE SAMPLES

Outstanding quality at competitive prices.
Se Habla Español

Service Monitor FOR SALE

Motorola R2200
GOOD CONDITION
Asking \$3,800 or Best Offer
Work (800) 695-7243
Voice Mail (714) 297-0686
David

USED Radius Radios WANTED!

California Radio → 800-231-0103

Radius P100 Close out MOTOROLA



SAVE THIS AD

SAVE THIS AD

MODELS AVAILABLE NEW UNIT PRICE

136-150MHz	5W	2F	\$270
136-150MHz	5W	6F	\$295
150-162MHz	1W	2F	\$225
150-162MHz	5W	2F	\$270
150-162MHz	SOLD 5W	6F	OUT \$295
160-174MHz	5W	2F	\$270
160-174MHz	5W	6F	\$295
405-430MHz	4W	2F	\$300
405-430MHz	4W	6F	\$325
450-470MHz	4W	2F	\$300
450-470MHz	4W	6F	\$325
450-470MHz	1W	2F	\$250
470-495MHz	4W	2F	\$300
470-495MHz	4W	6F	\$325
495-520MHz	4W	2F	\$300
495-520MHz	4W	6F	\$325

OPTIONS AVAILABLE WITH RADIO PURCHASE

Rapid Charger/Delete Std.	(CALL)
6-Unit Rapid Charger	(CALL)
Remote Spkr-Microphone	\$45 (New) \$25 (Recond.)
Extra Compact Charger	\$10 (New)
Carry Holder	\$5 (Recond.)

Radio Includes High
Power Rechargeable
Battery (N. Cd) Standard
Rate Desktop Charger
Flexible Antenna, Audio
Jack, Radio Holder With
Belt Clip—And A 3 Year
Warranty—Parts & Labor

AIR COMM CORPORATION

4614 E. McDowell Road • Phoenix, AZ 85008 • Sales: (602) 275-4505 • FAX: (602) 275-4555

SAVE THIS AD • SAVE THIS AD • SAVE THIS AD

Circle (158) on Fast Fact Card

INTERFACE EQUIPMENT

Wescom • Tellabs • Lenkurt

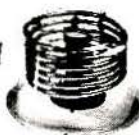
- Mounting Shelves
- Jack Fields
- MUX Shelves & Cards
- SF, FX Signaling Cards
- 2 Wire & 4 Wire

MANY MORE

VersaTel Ph: 1-800-456-5548
Fax: 1-307-266-3010

Untenna

Low Profile • Low Band
Antenna for Radio
Communication



FEATURES:

- Up to 95% Height reduction
- Easy Installation
- High Performance • Low Cost

Model CR109A
**THE ULTIMATE
LOW BAND**

COM-RAD INDUSTRIES
PO Box 554, Grand Island, NY 14072
For Immediate Fax Info & Technical Assistance,
Telephone: 716/773-1445

Buy - Sell - Radios - Test Equipment

Motorola Equipment:	
Syntors 100W UHF & VHF	\$149-\$299
Syntor Drawer Units	\$75-\$150
R100 Repeater & Duplexer (New)	\$875
MKOR 375W 42-50 Base (New)	\$3,600
MRTI with Paging	\$400
Series 90 DC Remotes	\$85
T1602 DC Remotes	\$125
MSR 2000 UHF 100W Repeater	\$4,500
Syntor X VHF 100W B mode	\$550
Micor 75W UHF Repeater	\$3,200
Televare 44A/N Wattmeters	\$150-\$190
R2400 Service Monitor (1 yr. old)	\$7,500
IFR 1200S Service Monitor (1 yr. old)	\$7,000
IFR 500A Service Monitor	\$3,500
IFR 1000A Service Monitor	\$2,700

Wanted: Service Monitors / Radius Products

RADIO ONE

Ph. 716-763-9104 or 716-661-9964
Fax 716-763-2000

Why Electro Dynamics Crystal? We go the extra mile!

LMR and Pager crystals for most
models. For the best delivery, quality
and price call: 1-800-332-9825.

1-800-EDC XTAL.

ELECTRO DYNAMICS CRYSTAL CORP.

9075 Cody
Overland Park, KS 66214
NOT JUST ANOTHER CRYSTAL CO.

Tower services

WE BUY TOWERS

WE WANT YOUR

Antenna Tower and Antenna Tower Site.
If you have a Tower for sale or own a site
where one should be, let us know.

ALL CASH PAID! 30 DAY CLOSING!

Will consider joint venture development.

REPLY BOX #922

M.R.T., P.O. BOX 12901
Overland Park, KS 66282-2901

S
A
V
E
T
H
I
S
A
D

WHY PAY MORE!

AIR COMM FURNISHES QUALITY — PRICE — SELECTION — DELIVERY

RECENT ARRIVALS

MOT 450-470MHz paging system consisting on (1) "Micor" 250W base (B84RCB) (1) "Moda 500" paging terminal w/UNI (Euqids) (200) "Spirit" pagers w/o chargers.	CALL
MOT "PT500" 150MHz, 5W, 8F c/s w/alk batt. pack (P33BBM), new mil.	\$125
MOT "Spectra" 900MHz 10/35W, 57B5/B7 series	CALL
MOT "PP500" 800MHz w/o access—some hds. avail. (T35J5A5G1G)	CALL
MOT "MX-340S" 150MHz, syn. 6W, 48F, pl w/o prom/ant. batt.	\$150
As above w/new prom/batt.	\$225
As above w/o modules—case only	\$25
MOT "MX/STX" 6 unit rapid charger (NLN8988)	\$175
MOT "Radius" M20E, 60W 8F, 30-36MHz (D51LRA)	\$350
MOT "MAXAR.80" 460MHz, 30W 1/4F DPL w/access.	\$175/200
MOT "Maxar.80" 150MHz, 25W 4F, PL w/ext'l spkr, access.	\$175
MOT "Maxar.80" 42MHz, 55W, 1/2F, PL w/access.	\$175/200
MOT "HT220" c/com model, 450MHz, 4W 4F, PL	\$50
MOT "HT220" 450MHz, remote only w/spcr/mic	\$50
MOT "Minitor I" 150/450MHz, w/reeds/charger	\$75
MOT "Micor" 150MHz, 110W, 8F, PL w/o access.	\$100
MOT As above 1/4F, c/sq. w/o access.	\$75
MOT "Micor" 450MHz, Mob reprtr, 5-10W	\$200
MOT "Radius" 150MHz Ant w/mini-UHF (HAD400E)	New 9
As above w/o whip	New 7
As above, RG-58 only	New 3
MOT "Syntorx/9000" Cable (HKN4121)	\$40
MOT "Series 9000" Cont. Hds (HCN1063/65/66/71)	CALL
MOT "System 9000" mic (HMN1061)	New 35
MOT "Spectra" mic (HMN1052)	\$30
MOT "Syntor" 1/4F, control HD (HCN1004/05)	\$25/30
MOT "Meratrac" 99F cont. HD (HCN1052)	New 50
MOT DTMF backlit mics (TDN8310) "Radius/Matrac"	New/used 85/105
MOT DTMF mic "Mostar" (HMN1001)	\$50
MOT "Maxar" pl hang up box (TRN6283)	New 7

SYNTHESIZED PORTABLE RADIOS

MOT "MX340S", 150MHz, 48F, GW, PL W/O BATT./ANT. \$150

AS ABOVE W/NEW E-PROM

BATT., ANT. \$225

AS ABOVE W/O SYNTHESIZER .. \$100

AS ABOVE W/O ALL MODULES .. \$25

MOT 6-UNIT RAPID CHARGER .. \$195



SIX PAK SPECIAL
(6) PORTABLES COMPLETE W/
(1) 6-UNIT RAPID CHARGER
\$1,400

PLUS: WE STOCK 150/450/800 MHZ MODULES "CONVERTA-COM" CHARGERS, SPEAKERS AND PARTS — BOTH NEW AND USED AT PRICES YOU CAN AFFORD

AIR COMM

TWO-WAY RADIO SALES

CALL FOR LOWEST PRICES • (602) 275-4505 • FAX(602) 275-4555

WE STOCK "PL", PAGING REEDS, AND CHANNEL ELEMENTS
4614 E. McDOWELL RD.—PHOENIX, AZ 85008

Circle (142) on Fast Fact Card

Publications

Use

Mobile

Radio

Technology

Classified

Ads

WIRELESS TECHNOLOGY LIBRARY

from Quantum Publishing



DIGITAL CELLULAR TELEPHONY

NEW RELEASE

An exciting series of 8 technically oriented video tapes created by Bernhard E. Keiser DScEE, which explores the use of digital techniques in public switched telephony networks. Topics include:

- Portable & Mobile Telephony
- Digital Transmission in Mobile Communications
- Spectrum Efficiency Measures
- Enhanced TDMA
- Microcells
- Parametric Speech
- Modulation & Multiplexing Concepts
- Satellite Transmission

Almost 13 full hours of material!



Call for our **free** 24 page catalog of books, video tapes, audio tapes, research reports, and software serving the wireless communications industry.

Quantum Publishing Inc.
P.O. Box 310
Mendocino, CA 95460
1-800-422-9666

Circle (157) on Fast Fact Card

Classified

Computer software

Computer Resources Inc.

The Service Management system is designed for the management of a mobile communications company. It provides the user with work orders, and work order history, inventory control and purchasing, contract management and costing, equipment management and costing, and technician productivity. Also available are Recurring Billing, SMR Billing, Pager Billing and Inventory, plus Accounts Receivable, Accounts Payable, General Ledger, and Payroll.

205/987-1523

Circle (146) on Fast Fact Card

Equipment wanted

Equipment Wanted

Motorola, Johnson, GE, EFJ, Uniden, Standard

Buy-Comm-Co.
1-800-347-4121

FAX (602) 585-6900

BUY & SELL

Used GE-MARC
Trunking Radios.

TMX 8310 TMX 8210
TMX 8510 TMX 8712
TMX 8825 TMX 8615

Call John Peacock

Tel. 800-232-7715

Fax 501-735-7799

WANTED DEAD OR ALIVE!

MOTOROLA BRAVO DISPLAY PAGERS
LOW BAND, VHF, UHF, 900MHz

Top Dollar Paid!

301-470-4253

LATIN AMERICA REPRESENTATION
Experienced and Technically qualified Rep. Organization, serving exclusively Latin America and the Caribbean, based in Miami Free Zone, Florida, looking for additional selected lines.

RADIO-TEC, INC.

2315 NW 107 Ave., Box 60, Miami, FL 33172
Fax: (305) 592-3828

COMPUTER ENGINEERING OF MICROWAVE SYSTEMS

(CEMS)

LAND MOBILE RADIO COVERAGE

(LMRC)

3 Second
Terrain Data

MICROWAVE

- Menu Driven - Color Coded
- On-Screen Path Profile Design
- Diffraction Loss Calculations
- Reflected Signal Analysis
- Route and System Diagrams
- Map Crossings - Graphic with Dimensions
- Performance Predictions - Analog, Digital and Video

LAND MOBILE RADIO

- Coverage Diagrams
- Multiple Prediction Models
- 360 Radials - 50 Mi (80 Km) Radius
- Relief Maps in Color
- Intermodulation Calculations
- 300 Tx and Rx Frequencies
- Up to 99th Order
- Graphic Presentations

NORTON ENGINEERING
10002 McDuff Court
Vienna, VA 22181
703/938-5745
Fax: (703) 938-9168

Demo Disk
and
Sample Printouts
Available



Circle (145) on Fast Fact Card

Introducing...



Model 1012C

The next generation of
status reporting equipment from:

Pyramid Communications

210 Main St. #153 Seal Beach CA 90740 Order Hotline: (414) 730-4190

Finally, a low cost reliable alternative to
Speedcall's™ 912C status reporter...

- * Direct replacement for aging units or add ons.
- * Status reporting, sel call, horn honk, interrogate, group call, console assign and ANI on PTT.
- * Parameters are front panel programmable. Extensive self test and alignment capabilities.
- * LTR™ and Motorola trunking compatible.
- * Compact: Only 5 1/4" x 4 1/4" x 1 1/4"

Suggested Retail: \$425⁰⁰

Circle (144) on Fast Fact Card

TCS

CONSULTING SERVICES

- Feasibility Studies
- Path Analysis
- Specifications
- License Assistance

30 Second & 3 Arc Second Data Bases Now Available

TECHNICAL COMMUNICATIONS SOFTWARE

P. O. Box 884 Montgomery, TX 77356 • (409) 588-3200 • FAX (409) 588-4434

ENGINEERING AID SOFTWARE

- Microwave Calculations
- Multi-Point (SCADA)
- Topo-Graph (Profiles)
- HAAT Calculations

Pyramid Communications Service Management Software

Version 3.0
Only \$279



Inventory Serial #'s
Radios Shop Eq Par
Shop History

Free Demo
& Manual

Mailing labels

Invoices

Kits

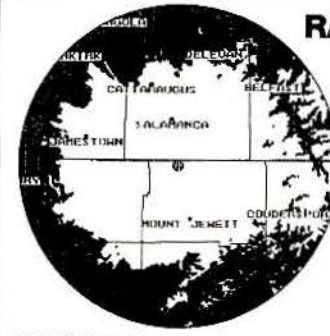
Productivity Reports

Customer Data

Repairs

Order Hotline

210 Main St #153 Seal Beach CA 90740 (414) 730-4190



RADIO ENGINEERING PRODUCTS

- ♦ **SOFTWARE**
 - 3-D Terrain
 - Coverage Predictions
 - Fresnel Zone Studies
 - Engineering Package
 - Intermodulation Studies
 - 3 or 30 Second Terrain Files
- ♦ **FCC INFORMATION**
 - Dial Access
 - State Frequency Lists
 - Custom Searches
 - Mailing Labels
 - Print-outs
 - Data Files

C.E.T., INC.
1001 S. Ridgewood Ave.
Edgewater, FL 32132
Phone: 904-426-0014 • Fax: 904-426-0099

Circle (147) on Fast Fact Card

Identify and prevent RF communications site interference in minutes rather than hours.

Powerful PC software that picks up where all other intermodulation programs leave off.

- Transmitter Noise/Receiver Desense Analysis
- Intermodulation Signal Level Analysis
- Eliminates Manual look-up of filter curves

COMSITE PLUS

For a brochure, call 1-800-845-0408

Rentals



MOTOROLA

RENTALS

- GP300, P200, HT600
- Mobiles, Repeaters
- Intrinsically Safe
- Dealers Welcome

1-800-822-MOSS

MOSS COMMUNICATIONS



Real World Propagation™

CDS offers you the tools to predict radio propagation coverage with unprecedented accuracy. CDS Real World Propagation™ Studies are an invaluable tool used in the design of RF communication systems. Call us to discuss how we can supply you with the resources you need. Other RF Engineering Tools include:

- Online/Remote Access Services
- FCC & FAA Databases
- 3 Arc Second Terrain Data
- 1990 Population Data

Communications Data Services, Inc.
6105 E. Arlington Blvd., Falls Church, VA 22044
(703) 534-0034 • (800) 441-0034

Circle (148) on Fast Fact Card

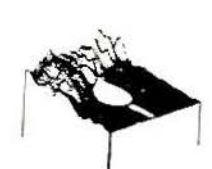
C\$ERVICE(R)

Service Management System

- Invoicing/Work Tickets
- Accounts Receivable
- Service History
- Contract Management
- Inventory
- Air-Time Billing
- Tech Efficiency
- Recurring Billing

Sage Data Systems
(Division of America West C&E, Inc.)
800-542-9378 • 307-382-5663 • FAX: 307-382-7323

Circle (149) on Fast Fact Card



Terrain Analysis Package (TAP)™

PC-based software for RF studies

- Area field strength coverage maps.
- Shadow maps.
- Choice of propagation models.
- Point-to-point/microwave fade margin and reliability calculations.
- User-customized data base for buildings and vegetation.
- Digital elevation data on floppy disk or CD-ROM.
- Intermodulation product studies.

Free demo disk upon request.

SoftWright
Limited Liability Co.
1010 South Joliet, Suite 204
Aurora, Colorado 80012
(303) 344-5486
FAX (303) 344-2811
Tele TAP BBS (303) 344-5378

Circle (150) on Fast Fact Card

MOTOROLA

RADIO RENTALS

- MT1000, HT600, P200
- Intrinsically Safe
- All Types Headphones
- Mobiles & Portapacks
- Repeaters & Crossband Sets
- Dealer Inquiries Invited

1-800-283-COMM
EVENT RENTAL COMM., INC.

Radio Sites

SET YOUR "SITES" ON US

WE can save you time and money. Call for a list of California's best kept secrets...805-945-5448.

If you don't we both lose money.

Accessories

WE WILL BEAT THE COMPETITION

Clearhousing, Bravo, BPR, holsters, chains & leathercases.

Over 12 colors available

BUY, SELL & TRADE PAGERS

Integrated Wholesale

12368 Hancock St., Carnell, IN (317) 573-8185

SMR BILLING / ACCOUNTS RECEIVABLE

\$396

*CES *IDA *Johnson *Trident *Uniden *Zetron

Billing

Recurring Billings (flat rate)
Daily Billings
Air Time Billing
Long Distance Billing

Accounts Receivable

Apply Payments
Generate Statements
Print AR Ageings
Generate Service Charges

- Handles all of your business billings.
- Easy to understand and learn.
- Requires a minimum of file data keying.
- Mix or match different download formats.
- Simple and flexible approach to sales taxes.
- General Ledger Interface.

CLEVER SOFTWARE

3033 13th Ave. SW, Suite #139
Fargo, ND 58103

Phone: 701-237-0095 Fax: 701-237-0228

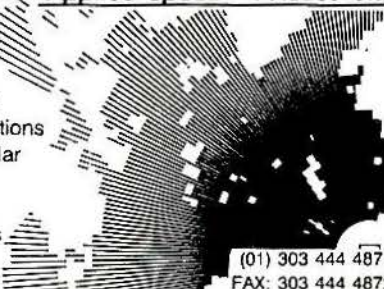


Advanced RF Coverage and Propagation Software

Applied Spectrum Research

- * Radio Area Coverage
- * Path Profiles
- * Land Use/Vegetation
- * Easy to Use on Your PC
- * Full Range of Design Options
- * Single or Multi Site/Cellular
- * Digital Topography
- * Geographic Boundaries
- * International Applications

2975 Valmont # 100
Boulder, CO 80301 USA



(01) 303 444 4871

FAX: 303 444 4872

The SENTRY "Service Manager"

The technicians very own encyclopedia of service department information. A collection of over 50 Programs, Charts, Formulas and Conversion Factors. Information required daily, now on your service shop computer.

Faster than looking it up in a book..

Send \$ 79.95 Check or Money Order to:

SENTRY USA®

P.O. Box 372416

Indian Harbour Beach, FL 32937-0416

Telephone (407) 773-6090 FAX (407) 773-6092

Circle (151) on Fast Fact Card

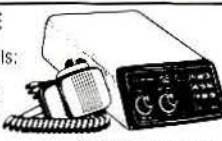
Repair services

\$25.00 FLAT RATE

Plus Parts & Shipping

On the following models:

XLH-250 RH-250
RH-256 WH-256
WH-2510 RFH-252
UC-102 UC-202
TRH-202



REGENCY/WILSON

*OTHER MODELS—\$25/HR Plus Parts & Shipping

MULTICOM

2608 N. Moore Ave.

Moore, OK 73160-3316

405-799-7356 800-880-7356

• FAST TURNAROUND

• FACTORY TRAINED

• VISA - MASTERCARD - COD

TWO-WAY

REPAIR \$30/hr*

A.S.K. COMMUNICATIONS

3101 W. Thomas Rd. #114

Phoenix, AZ 85017

1-800-827-0747

*Plus parts & shipping

QUALITY REPAIRS

• MOTOROLA

• STANDARD

• UNIDEN

• JOHNSON

• MIDLAND

• AND MANY MORE!

MOBILES & PORTABLES,
800 CONVENTIONAL

Repair services

NS ELECTRONICS SERVICE INC.

COMMUNICATIONS MONITORS SALES & SERVICE

N.I.S.T. TRACEABLE CALIBRATION

CUSHMAN IFR

SALES NEW-USED

3610 Dekalb Technology Parkway

Suite 110/111

Atlanta, Georgia 30340

(404) 451-3264

Fax: (404) 458-8785

CALL

AUTHORIZED
CUSHMAN SERVICE

BENDIX / KING

Authorized Service Center
Repair Services for all your
communications needs!

- FREE Estimates
- 90-Day Warranty
- Quick Turn-around
- FM / AM / SSB / CW
- Northwest Location

SKYLINE RADIO (503) 663-5858

ACS

"The Pager Repair People"

High quality, cost effective, and guaranteed pager repair. Flat rate labor (plus parts and shipping) on Motorola, NEC, Panasonic and Shinwa.

(303) 337-4811 FAX (303) 337-3048



**Triton
Electronics, Inc.**

SERVICE MONITOR

REPAIR & CALIBRATION

Exclusive monitor repair since 1973

NIST TRACEABLE

Cushman, IFR, Motorola, Marconi

4300 Lincoln Ave., Unit O

Rolling Meadows, IL 60008

(708) 934-6426 Fax (708) 934-7195

CALL

SALES & SERVICE
FOR NEW MODEL DEMOS

KNS ELECTRONICS, INC.

2146 BERING DRIVE

SAN JOSE, CA 95131

PHONE: 408-432-8100

FAX: 408-432-8359

MODEL 7130

TRACKING GENERATOR

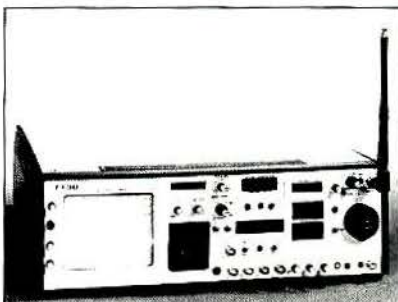
OFFSET GENERATOR

1 GHZ GEN & REC

SPECTRUM MONITOR

ENCODER

CUSHMAN



Circle (152) on Fast Fact Card

Classified

There's a hidden message in Part 88 about your future, "go away!"

for more information call toll-free
(800) 769-AMRA

AMRA American Mobile Radio Association, Inc.

Services

STUDY LAND MOBILE COMMUNICATIONS AT HOME!

38 lessons written exclusively for Mobile Communications Servicing. \$375.00. Call or write for free information:



P.O. Box 8278
Lumberton, TX 77711-0278
(409) 755-7838



DUPLETUNE
303 FRUIT RD
TUNAWANDA, NY 14150
716-834-2787

**REPAIR & RETUNING OF
DUPLEXERS
Filter Systems
Rx Multicouplers**

If you have a million \$ business & 10 repeaters you can enter the Part 88 lottery... if not, don't give up your day job.

for more information call toll-free
(800) 769-AMRA

AMRA American Mobile Radio Association, Inc.
P.O. Box 33847, Washington, DC 20033 • Telephone (202) 547-6545

Circle (153) on Fast Fact Card

!!! FCC FREQUENCY INFORMATION !!!

Parts 90, 95 and 22

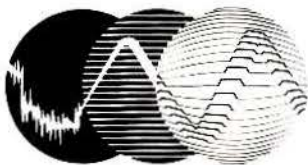
Custom Reports: Marketing or Engineering—Your Geographic Area
Demographic & Boundary Information Available for report integration.
Database Updated Daily

• Private Land Mobile Radio Services • Common Carrier and Private Carrier Paging • Cellular Licensees with Cell Sites
• SMRs-Trunked and Conventional • VHF and UHF Control Links

Output on diskette or 9 track tape (printouts also available) for easy analysis of your data:

- Sort by your priority
- Identify potential customers
- Identify potential interference
- Locate transmitters
- Only the information fields you want
- Print mailing labels
- Identify used and unused frequencies

Call or Fax your request for a FREE ESTIMATE



COMSEARCH

Business Information Services—251 West Renner Road, Richardson, TX 75080
Phone: 214/680-1000 Fax: 214/680-9802

Circle (154) on Fast Fact Card

FCC License Preparation

Fast, Easy, Home Study, Inexpensive.
Land Mobile Handbook, New Employment Guide.
Audio & Video Courses Available.

FREE Details
WPT PUBLICATIONS
1-800-800-7588

PARKER ELECTRONICS

LAND MOBILE & MARINE ELECTRONICS
SALES AND SERVICE

Fastest Delivery and Best Prices



619 Front Street
P.O. Drawer H
Georgetown, S.C. 29440
Phone: 803-546-9351



Skunk Shoppe!

A Division of Shadow
Technologies Group L.C.

- AFTER MARKET OPTIONS
MODULE INSTALLATIONS
- SMALL OR LARGE QUANTITIES
- MOST BRANDS OF MODULES
AND RADIOS
- MODIFICATIONS AND DISCOVERY
INSTALLATIONS

CALL FOR A PRICE QUOTE TODAY

PH. (913) 749-3566
FAX (913) 749-1036

Tower space



STAN STANN

TEL: (708) 823-7713

**CHICAGO TOWER
LEASING CORP.**

**COMMUNICATIONS
TOWER & ANTENNA
SITES FOR THE
METROPOLITAN CHICAGO
AREA**

P.O. Box 31150
CHICAGO, IL 60631

NEED TENANTS??

Advertise your sites in the
**NATIONAL COMMUNICATIONS
SITE DIRECTORY**

Dedicated to advertising antenna sites for lease

NEED SITES?

The NCSD contains hundreds of prime
antenna sites across the Nation.

To get your copy write or call:

INTRA-FAM, Dept. M, P.O. Box 6093
Freehold, NJ 07728 (908) 462-5964

SAVE TIME

For fast, accurate service, please
remove the Peel-Off Label (which is used
to address your magazine) and affix it to

the Fast Fact Card, the Address
Change Card, or to any correspondence
you send us regarding your subscription.

John M. Rowe
Communications Real Estate
Site Acquisition, Site Marketing &
Zoning Specialist
1236 Corona #2
Denver, CO 80218
(303) 830-0815





Discover the quality of a Falcon tower.

Our craftsmen manufacture quality custom engineered structures for all applications in the communications industry. These include guyed and self-supporting towers, as well as monopoles and specialty mounts.

(915) 658-7155

FALCON
Tower Fabricators

FAX (915) 658-5192 • 625 PREUSSER • SAN ANGELO, TEXAS 76903
FABRICATION (512) 547-9111 • HCR 1 BOX 2000 • SANDIA TEXAS 78383

PRIME NORTHERN NEVADA SITES

Our newest, Pond Peak, at 8035' AMSL, 2635' AAT, Emergency Power, Air Conditioning, Overlooking Reno, Fallon and the I-80 corridor,

702-825-2626

GREAT BASIN COMMUNICATIONS

SEATTLE AREA

Commercial power with generator backup.
Good security. Year around access.

GOLDSPAR COMMUNICATIONS

206-475-9430

Fax 206-475-9410

TOWER SPACE

Westchester • Putnam • Rockland
Connecticut

Combiners 70-960MHz Bogner and Antel antennas 450-960MHz with downtilt and null fill. Satellite earth station antenna available. Emergency generator, A/C. Elev. over 1,000 ft. Easy access all year. Covers Westchester, Putnam, Rockland and parts of Conn. Contact Jerry Agliata.

SIGNAL TOWER COMPANY, INC.

914-633-0569 • Fax 914-633-9315

Tower Space Available

45 miles west of Washington, DC
Loudoun County, VA — Mount Weather
Lat. 39°05'05"N — Long. 77°51'38"W
1900 AMSL — Wide Area Coverage

28 miles west of Washington, DC
Lat. 38°54'23"N — Long. 77°40'20"W
1366 AMSL — Covers Western Areas of Washington, DC Metro Area

28 miles northwest of Minneapolis, Minn.
Elk River, Minn.
Lat. 45°20'35" — Long. 93°34'18"
1325 AMSL — Wide Area Coverage

Contact: Ken Van Patten
Northwest Tower Service, Inc.
(703) 255-9781 Fax (703) 255-1292

Free!

Here's the first step designed to save you time and money!

Whether you're a communications newcomer or an experienced pro, you'll find this handy booklet invaluable for:

- ✓Paging
- ✓Dispatch
- ✓Cellular
- ✓Broadcast
- ✓Personal or Business
- ✓Specialized Mobile
- ✓Satellite
- ✓Microwave
- ✓Telemetry
- ✓Data

When you need help in selecting a communications site, call the northern California experts. With 33 well-managed sites in key locations and a personable, dedicated staff, we'll get you up and on-the-air fast.



DIABLO COMMUNICATIONS, INC.

1220 Brickyard Cove Road, Point Richmond, CA 94801
(510) 236-3700, Fax (510) 236-3799 Ask for Mr. Pringle

The California SITE SELECTION Check List



- The answers to—
- ✓Choosing a site
 - ✓FCC requirements
 - ✓Risks
 - ✓Leases
 - ✓Maintenance
 - ✓More

The California
SITE SELECTION
Check List
(510)-236-3700
Fax (510)-236-3799

Circle (155) on Fast Fact Card

Looking For Towers Here?



TWO BALA PLAZA, #300

Try Looking Here First



Circle (156) on Fast Fact Card

FRYER'S SITE GUIDE'S

Mid-States Edition is now available featuring over 9,000 antenna sites and 45 pages of 1"x1" maps covering towers from Tennessee to Michigan.

COST: \$200

Regions to follow are
Southeast, Panhandle/Gulf, East, West and Plains.
Reserve your copy now!
Call 215 660-7804.

on sale at our IMCE booth in Anaheim!

BALA CYNWYD, PA 19004

37 CALIFORNIA ANTENNA SITES

- Major Locations • Stand-by power
- Secure facilities • Air Conditioning



Or develop your own site.
Land available at
Oat Mountain/Chatsworth.

MERIDIAN COMMUNICATIONS

Since 1956

23501 Park Sorrento, Ste. 213A

Calabasas, CA 91302-1355

Contact Rich or Jack Reichler at

818/888-7000

ARIZONA'S PREMIER TOWER FACILITIES

Contact Dave or Charlie Bonifasi

ANTENNA SITES, INC.
602-451-7702



STAR TOWER 621 Mehring Way, #1907
Cincinnati, OH 45202
(513) 621-9292

Leased
Antenna
Sites

OHIO — KENTUCKY — INDIANA

Cincinnati's Tallest Tower
Call Jim Stitt

Broadcast • SMR/Trunking • Cellular
2-Way Base Stations • Repeaters
Microwave • Links • MMDs/ITFS • Paging

LOUDOUN COMMUNICATIONS, INC.Communications Systems
REPAIR DEPOTMicroprocessor based Mobiles,
portables, controlheads.
GE Warranty Processing
Fast turn-around585 Factory Shoals Road
Austell, GA 30001

404/948-9566

**COMMUNICATIONS
SITE SPECIALISTS.**

- ✓ Site Selection, Acquisition, Development, Construction, Engineering, Management, Marketing.
- ✓ Sites Available Now ... IL, IN, MA, MD, MI, MO, NC, OH, TX, & VA

**FACILITIES MANAGEMENT, INC.**10 Woodbridge Center Drive, Woodbridge, NJ 07095
(908) 636-6970 • FAX (908) 636-7260 • Toll-Free (800) 247-4796

© 1991 RAM Facilities Management, Inc.

Circle (159) on Fast Fact Card

A d index/hot line

Company	Page Number	Fast Fact Number	Advertiser Hot line	Company	Page Number	Fast Fact Number	Advertiser Hot line
Air Comm	105,106	158,142	602-275-4505	Maxrad, Inc.	17	15	800-323-9122
Alexander Batteries	70	64	515-423-8955	McManus Communications	101	133	501-763-6250
America West C&E, Inc.	108	149	800-542-9378	Mechem Electronics	102	137	703-373-3888
Antenex	87	81	800-323-3757	Meridian Comms/Diablo Comms	63	57	818-888-7000
The Antenna Specialists, Co.	IFC	1	216-349-8400	Meridian Comms-Comms Express	103	140	800-631-7297
Antenna World, Inc.	99	125	800-637-0222	Microflex	55	49	503-363-9267
APCO National Conference	69	63	800-949-2726	Microwave Filter Company, Inc.	74	69	315-437-3953
Astron Corp.	47	42	714-458-7277	Midian Electronics, Inc.	59	54	602-884-7981
Automation & Electronics Engr.	100	130	800-527-4596	Midland International LMR	37	33	800-MID-LAND
Avcom of Virginia	84	88	804-794-2500	Mobile Mark, Inc.	24	21	800-648-2800
Avtec, Inc.	42	37	803-892-2181	Modular Communication System	46	41	818-764-1333
BatteryPRO Centres, Inc.	93	99	800-661-9401	Monark International Corp.	90	104	816-891-0700
B&C Communications, Inc.	102	139	800-343-3004	Motorola Government	15	13	800-235-9590
BEE Electronics, Inc.	80	76	708-345-0337	MX-COM, Inc.	7	7	919-744-5050
Bendix/King, Mobile Comms Div.	73	67	913-842-0402	New Mar	100	129	800-854-3906
Bomar	16	14	800-526-3935	Norton Engineering	107	145	703-938-5745
BRAMCO, Inc.	36	32	513-773-6255	Omicron Electronics	94	102	203-928-0377
Cartwright Communications	23	20	513-489-1755	PageTek, Inc.	82	78	919-876-8294
Celwave	11	9	800-321-4700	PanaVise Products, Inc.	52	46	702-353-2900
Central Tower, Inc.	94	101	812-853-0595	Pathcom Corp.	33	29	903-586-9812
Centurion International, Inc.	9	8	800-228-4563	Pekarr Communication, Inc.	100	131	201-772-0704
C.E.T., Inc.	108	147	800-445-0297	Polyphaser Corp.	85	91	800-325-7170
CES, Inc.	75	70	407-679-9440	Primus Electronics Corp.	99	127	800-435-1636
Chargeguard Corp.	101	135	800-458-3410	Pyramid Communications	107	144	310-430-5892
Cimarron Technologies	25	22	800-487-7184	Quantum Publishing, Inc.	106	157	800-422-9666
David Clark Co., Inc.	35	31	508-751-5800	Radiocomm Assoc. of Canada	83	79	416-252-7791
Communications Associates	30,97	26,143	800-435-9313	Radiomate	99	128	800-346-6442
Communication Data Services	108	148	800-441-0034	Radio Wholesale	99	126	800-53-RADIO
Communications Specialists	BC	3	800-854-0547	Ralco Electronics	41	36	800-567-8884
Comsearch	110	154	214-680-1000	Ramsey Electronics	98	121	716-924-4560
Connect Systems, Inc.	13	11	800-545-1349	RCW Distributing	98	120	800-726-9015
Control Signal Corp.	14	12	303-989-8000	Ritron, Inc.	65	59	800-USA-IUSA
CPI Communications, Inc.	74	68	800-869-9128	Sabre Communications	34	30	712-258-6690
C+ Software	100	132	819-563-0133	Santa Fe Distributing	64	58	913-492-8288
Cushcraft/Signals Corp.	27,54	24,48	800-258-3860	Schlumberger Technologies	39	34	800-225-5765
Cushman/KNS Electronics	109	152	408-432-8100	Selectone Corporation	3	5	800-227-0376
Datacom, Inc.	86	93	217-222-0160	Sentry Services Int'l	109	151	407-773-6090
Decibel Products, Inc.	29	25	214-631-0310	Shadow Technologies	90	105	913-749-3566
Diablo Communications, Inc.	111	155	510-236-3700	Sharp Communication	99	124	800-548-2484
DX Radio Systems	77	72	213-257-0800	Shure Brothers, Inc.	49	44	800-25-SHURE
Dynatech Tactical Comms	66	60	603-880-4411	Siemens Solar Industries	56	50	805-338-6341
Earmark, Inc.	84	89	203-777-2130	Simrad, Inc.	93	98	800-426-5565
EMR Corp.	88	83	602-581-2875	Skaggs Telecomms Service, Inc.	78	73	801-261-4400
Fischer Custom Comms, Inc.	84	90	310-644-0728	Softwright	108	150	303-344-5486
Flash Technology Corp. of AM	88	86	615-377-0600	Solar Electric Specialties	87	80	707-459-9496
Frequency Management	98	122	800-800-9825	Southern Computer Corp.	102	138	800-752-3571
Fryer's Site Guide	111	156	215-660-7804	Standard Communications	45	40	800-767-6695
Gamber Johnson	44	39	715-344-3482	STI-CO Industries, Inc.	20	17	716-662-2680
General Communications	71,101	65,136	800-356-3200	Tait Electronics USA, Inc.	22	19	713-984-8684
Harger Lightning Protection	86	94	708-362-4848	Tekk, Inc.	57	51	800-521-TEKK
Henry Radio	68	62	800-877-7979	Telepoint, Inc.	91	95	310-652-3666
Hustler, Inc.	88,89	82,85	800-949-9490	Tower Structures, Inc.	76	71	619-421-1181
Hutton Communications	48	43	800-442-3811	Transcript International Ltd.	5	6	800-228-0226
Hy-Q International	101	134	606-283-5000	Trylon Manufacturing Co. Ltd.	93	90	519-669-5421
ICI Systems, Inc.	58	52	800-779-1917	Uniden Corp. of AM - MSG, Inc.	19	16	817-858-3300
IDA Corp.	53	47	701-280-1122	Unipage	67	61	800-367-2864
IFR Systems, Inc.	31	27	316-522-4981	Valmont Industries, Inc.	72	66	402-359-2201
Interconnect Specialists, Inc.	89	84	407-332-0533	VCP International, Inc.	80,87	75,87	800-527-9366
International Crystal Mfg.	94	103	405-236-3741	Vega, A Mark IV Company	1	4	818-442-0782
Kyocera/Photocomm	92	97	619-576-2672	Vertex/Yaesu USA	IBC		310-404-2700
Kyodo West, Inc.	51	45	800-535-2082	Vocom/RF Corporation	95	107	800-USA-MADE
Larsen Electronics	32	28	800-426-1656	Wacom Products, Inc.	86	92	817-848-4435
Leathersmith	95	106	800-233-0440	WAVETEK	43	38	800-245-6356
Marketronics Corp.	12	10	800-845-1230	W&W Associates	61	56	800-221-0732
Maxon America, Inc.	21	18	816-891-6320	Zetron, Inc.	26,40,92	23,35,96	206-820-6363

My communication is critical-- we switched to VERTEX!



You don't need an emergency for dependable transmitting and receiving to be critical. VERTEX believes it's necessary all the time. With 35-plus years of radio communications leadership, our reputation for high-tech innovation and rugged reliability is well-known.

VERTEX delivers superior UHF,

VHF and Low-Band Mobiles and Handhelds backed by a 3-year warranty, competitively priced – without sacrificing quality, no matter what your budget.

For details on the VERTEX VHF/UHF compact handhelds, complete 4, 12/24 and 99 channel mobile line and our exclusive dual-

band handheld with MIL STD 810 C/D and FCC Part 80 see your nearest VERTEX dealer or call today!



vertex
RADIO COMMUNICATIONS



• United States – (310) 404-2700, Yaesu U.S.A. • Central & So. America – (305) 593-2500, Yaesu Int'l Sales • Canada – (800) 567-6664, Omni Provincial Electronics

© 1992 Yaesu U.S.A., 17210 Edwards Rd., Cerritos, CA 90701 Specifications subject to change without notice or obligation.



Dynamite Discovery

Communications Specialists' latest excavation brings to light yet another dynamite discovery—our new dip switch programmable SD-1000. No need to tunnel your way through Two-Tone Sequential decoding anymore. We've mined this amazing unit! Now, for the first time, you can stock one unit that will decode all calls in a 1000-call paging system with $\pm .2$ Hz crystal accuracy. The EEPROM on-board memory can even be programmed for custom tones, and every unit includes group call. Universal switched outputs control your call light, squelch gate and horn. The SD-1000 can

also generate CTCSS and decode Two-Tone Sequential. Its miniature size of 2.0" x 1.25" x .4" is no minor fact either, as it's a flawless companion for our PE-1000 Paging Encoder. We ensure one-day delivery and our one-year standard warranty. Tap the rich vein of Communications Specialists and unearth the SD-1000 or other fine gems.



Circle (3) on Fast Fact Card

COMMUNICATIONS SPECIALISTS, INC.
 426 West Taft Avenue • Orange, CA 92665-4296
 Local (714) 998-3021 • FAX (714) 974-3420
 Entire U.S.A. 1-800-854-0547

Outside USA or Canada: Jescom International / 1 Waters Park Dr. #117 / San Mateo, CA USA Phone (415) 574-1421 / FAX (415) 574-5297 - Also in Italy and Spain